Acta Scientific Women's Health (ISSN: 2582-3205)

Volume 8 Issue 1 January 2026

Research Article

Nutritional and Health Status of Pregnant Women in Third Trimester with Malaria in Rural Communities in South Eastern States of Nigeria

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Received: January 01, 2026

Published: December 31, 2025

Abstract

This study investigated the nutrition and Health status of pregnant women in third trimester with malaria in rural communities in South Eastern States of Nigeria. It was a cross-sectional survey comprising of four hundred women in their third trimester. A multi-stage sampling technique was adopted in the recruitment of the subject used for the study. It involved the selection of four LGA in South Eastern States, four from each of the selected Five States (Abia, Anambra, Ebonyi, Enugu and Imo State) which was carried out by balloting. A well-structured and validated questionnaire was used to collect information on socioeconomic data and health data. Height was measured using meter rule, weight and body composition parameters were measured using bioelectrical impedance analyzer (model Omnon- HBF-511B-E). Maternal biochemical parameters (Lipid Profile, liver function, blood glucose, Malaria Parasitemia, Zinc, Folate, Vitamin B levels, Renal function, hemoglobin concentrations, and iron levels were all analyzed. Data was analyzed using descriptive statistics, Pearson's bivariate correlations was used to evaluate the relationship between all the health parameters. Of the 400 respondents, 19.8% had diabetes, 19% had high blood pressure, and 5.0% had preeclampsia while none had proteinuria. Few of the respondents were overweight during this their third trimester assessment as their records showed over weight during first and second trimesters respectively. 19% of the respondents were overweight in first assessment from records and showed 41.8% overweight in their third trimester assessment. Correlation analysis among pregnant women in their third trimester revealed generally weak associations between maternal biochemical parameters and the outcome variable under investigation. Lipid profile ($r = 0.022$), liver function ($r = 0.012$), blood glucose ($r = 0.001$), malaria parasitemia ($r = 0.006$), zinc ($r = 0.007$), folate ($r = 0.005$), and vitamin B levels ($r = 0.027$) all demonstrated very weak positive correlations. Conversely, renal function ($r = –0.033$), hemoglobin concentration ($r = –0.009$), and iron levels ($r = –0.055$) showed weak negative correlations. These findings suggest minimal linear relationships between the assessed parameters and the studied outcome, indicating that other factors may play a more substantial role in influencing maternal health status during late pregnancy. However, other findings from this study showed that the high prevalence of overweight and obesity observed could be linked to the moderate nutritional knowledge of the respondents, also more precisely higher nutritional attitude is not associated with better weight gains in pregnancy.

Keywords: Third Trimester; Pregnancy; Malaria; Health - Status; Nigeria

Introduction

Malaria is a major public health problem in 97 countries and territories in the tropics and subtropics. Globally, approximately 214 million cases of malaria occur annually and 3.2 billion people are at risk of infection [13]. Approximately 438,000 deaths were attributed to malaria in 2015, particularly in sub-Saharan Africa, where an estimated 90% of all malaria deaths occur [13]. As a critical target of the Millennium Development Goals, in 2005, the World Health Assembly established a goal of reducing malaria cases and deaths by 75% between 2005 and 2025 [13]. Hence, over the past decade, there has been greatly renewed interest in research and innovations in diagnostic methods, drugs and vaccines, and the development of control measures to eradicate malaria [5]. As a result, between 2000 and 2023, the incidence rates of malaria fell by 30% globally, and by 34% in Africa [6].

Nigeria suffers the world's greatest malaria burden, with approximately 51 million cases and 207,000 deaths reported annually (approximately 30% of the total malaria burden in Africa), while 97% of the total population (approximately 173 million) is at risk of infection [10]. Moreover, malaria accounts for 60% of outpatient visits to hospitals and led to approximately 11% maternal mortality and 30% child mortality, especially among children less than 5 years [10]. Studies have shown that 40% of pregnant African women present for the first time to antenatal clinics in the second trimester of their pregnancy [4,5]. The insecticide treated nets (ITNs), part of the prevention package delivered during the first antenatal clinic visit would provide additional protection for the mother during the remaining trimesters of pregnancy and into the post-partum period, as well as protection for the newborn through at least the first year of life [4,5].

In Africa, 30 million women living in malaria endemic areas become pregnant each year. For these women, malaria is a threat both to themselves and to their babies, with up to 2 million newborn deaths each year as a result of malaria in pregnancy [4,5].Pregnancy exacerbates malaria through a non-specific activity of the immune system. The protective anti-plasmodia activity is suppressed at pregnancy, which has clinical consequences with important public health implications on pregnant women [15]. The symptoms and complications of malaria during pregnancy differ with the intensity of malaria transmission and the level of immunity the pregnant women has acquired [4,5]. Malaria infection of the mother may result in a range of adverse pregnancy outcomes [NFMHNM., *et al*. 2019]. Hence it is regarded as the most important parasitic disease [8], which causes spontaneous abortion, neonatal death, low birth weight and intrauterine growth retardation [2]. The resultant impairment of foetal nutrition contributing to low birth weight is a leading cause of poor infant survival and development [9].

More than 90% of the total Nigerian population is at risk of malaria and at least 50% of the population suffers from at least one episode of malaria each year [3]. The initiative 'Roll Back Malaria' launched in 1998 in partnership with the United Nations Children's Fund (UNICEF), WHO and many other non-governmental agencies seems not to be producing effective results in some malarial endemic communities of Nigeria as malaria problem is still on the increase. Many studies have reported high prevalence rates of malaria in pregnancy in different parts of Nigeria, ranging from 19.7 to 72.0% [4]. With such reported high prevalence, there is a need to determine the extent of infection by Plasmodium falciparum in endemic communities of Nigeria as this will help in the proper management of the disease and its health effects.

The major objective of the study was to assess the nutritional and health status and risk factors of malaria among pregnant mothers in their third trimester rural communities in selected five states in the South Eastern States of Nigeria. The results of the above study will be of immense significance to nutritionists-dietitians as it will provide knowledge on the risk factors of malaria and suggest avenues to combat them. Government policies can be channeled towards alleviating malaria in pregnancy within rural communities and beyond.

Materials and Methods

Study area

The study was conducted using total of 400 pregnant subjects in their third trimester among the five different selected states. These states (region) are located in the South-Eastern part of Nigeria, and its geographical coordinates fall within the range of approximately 5° 31' North latitude and 6° 54' East longitude. Selected states include Abia State, Anambra State, Ebonyi state, Enugu State and Imo State). In the rural communities four Health Centres each of the selected states were used among the LGA of the different selected states and 20 people were picked from each of the selected L.G.A. Imo State has 27 LGA, Abia State Has 17 LGA,

Anambra state has 21 LGA, Ebonyi state has 13 LGA, Enugu state has 17 LGA. The selected Four LGA each for the study through balloting include; Imo State (Aboh Mbaise, Ahiazu Mbaise, Ehime Mbano and Owerri North), Abia State (Aba North, Aba South, Arochukwu and Umuahia North), Anambra State (Aguata, Awka North, Awka South and Ihiala), Ebonyi State (Abakiliki, Afikpo North, Afikpo South and Izzi), Enugu State (Aninri, Awgu, Enugu East and Nsukka). These areas are also characterized by a significant proportion of mothers, making it an ideal setting for this study on pregnant women in their third trimester. The diverse cultural practices in this region in their different communities regarding infant care and nutrition further enhance the relevance of the study. The data collected from this area provided a comprehensive understanding of the nutrition and health status of pregnant women with malaria in their third trimester in south eastern rural areas, which contributed to addressing gaps in maternal nutrition in Imo State [7,10].

Number of study desired

Determining the appropriate number of study participants is crucial in ensuring the validity and reliability of the research findings. The sample size for this study is carefully selected to represent the target population effectively while accounting for potential non-responses or data inconsistencies. The study focuses on pregnant mothers. To achieve statistically significant results, the sample size is determined based on factors such as the total population of mothers at the health centre, previous studies conducted on similar topics, and standard sampling methods recommended for cross-sectional surveys (Creswell and Creswell, 2018).

Preliminary visit to the place of survey

Before conducting the main study, a preliminary visit was made to the Health Centres to assess the feasibility of the research and establish rapport with healthcare providers and potential participants. This visit was essential in understanding the healthcare setting, the availability of mothers and caregivers, and the general structure of child health services provided at the centre. Engaging with healthcare workers helped clarify the best approach for administering questionnaires and conducting interviews while ensuring minimal disruption to routine medical activities.

During the visit, discussions were held with the health centre management regarding the study objectives, ethical considerations, and the importance of obtaining informed consent from participants. Observations were also made concerning the infrastructure, patient flow, and any potential challenges that might arise during data collection. These preliminary findings helped refine the data collection strategy, ensuring that the study aligns with the local context and maximizes participation rates (Bryman, 2016).

Furthermore, the visit facilitated the identification of key stakeholders, such as nurses, midwives, and community health workers, who could assist in the study by providing insights into infant and young child feeding practices within the community. Their input was valuable in adapting the research tools to be culturally and contextually appropriate. The preliminary visit also served as an opportunity to test the survey instruments, allowing necessary modifications to be made before the full-scale data collection commenced.

Survey design

This study adopted a cross-sectional survey design to collect data from pregnant mothers. A cross-sectional survey is appropriate because it will allow for the collection of data from a large sample at a single point in time, providing insights into the nutrition and health status of pregnant women. The survey involved the distribution of questionnaires to pregnant mothers in their third trimester, focusing on their feeding practices, knowledge of nutrition, and the challenges they face in adhering to optimal feeding practices.

Sample selection

The sample for this study consisted of pregnant women with malaria in their third trimesters. A multi-stage sampling technique was used to ensure that the sample is representative of the diverse communities within the LGA. The first stage involved the random selection of communities, ensuring that rural areas are represented. The second stage will involve the random selection of households within each selected community [8].

Sample size determination

The sample size for this study was determined using the **Taro-Yamane formula** (1967), which is commonly used in social science and health-related research when the population size is known. The formula is:

$$n = \frac{N}{N1+N(e)^2}$$

Where:

n = sample size

N = population size

e = level of precision (also called margin of error), usually 0.05 for 95% confidence level

The estimated total number of eligible pregnant women in the study area is N = 2800.

Using a margin of error (e) of 0.05 (for 95% confidence level):

$$n = \frac{2800}{1+2800(0.05)^2}$$

$$n = \frac{2800}{1+2800(0.0025)}$$

$$2+2800 \times 0.0025=1+7=8$$

$$n = \frac{2800}{8}$$

$$n = 350 \approx 400$$

Therefore, the sample size was calculated to be 350 but rounded of to 400pregnant women. This size was considered appropriate to ensure representativeness and reliability of the findings, while also being feasible for the available resources and timeframe of the study.

Validation of study

The validity of the study was ensured through both content and construct validity. Content validity was achieved by ensuring that the survey instrument (questionnaire) adequately covers all relevant aspects. Construct validity was established by pre-testing the questionnaire in a small subset of the target population in a similar setting.

Data collection method

Data for this study was collected using a structured questionnaire, which was administered to pregnant mothers The questionnaire will be designed to capture information on the following areas: Socio-economic characteristics of the subjects, Health information of the respondents, Anthropometric data of the respondent, Correlation between pregnant women and their health status.

The data collection process was carried out by trained enumerators who are familiar with the local language and culture of the study area. Enumerators were trained to ensure consistency and reliability in administering the questionnaire. In addition to the questionnaire, qualitative data may be collected through interviews or focus group discussions with a smaller sample of participants to gain deeper insights into the socio-cultural and economic factors influencing nutrition and feeding practices among pregnant women [13].

Data analysis

The data collected was analyzed using both quantitative and qualitative methods. Quantitative data was entered into a statistical software program (such as SPSS or STATA) and analyzed using descriptive statistics (e.g., frequency distributions, percentages) to summarize the participants' demographic characteristics and feeding practices. Inferential statistical methods, such as chi-square tests or multiple regression analysis, was used to explore associations between independent variables (e.g., socio-economic status, maternal education, healthcare access) and dependent variables (e.g., feeding practices, infant nutrition outcomes).

Qualitative data from interviews or focus group discussions will be transcribed and analyzed thematically to identify key themes and patterns related to the barriers and facilitators of optimal maternal feeding practices. The finding was triangulated with the quantitative results to provide a comprehensive understanding of the factors influencing feeding practices in the study area.

Statistical analysis

Statistical analysis was conducted using SPSS (Statistical Package for the Social Sciences) version 22.0 or higher. Descriptive statistics, including frequencies, percentages, and mean scores, was used to summarize demographic characteristics and biochemical analyzed data results. Correlation tests analysis were used to examine the association between categorical biochemical variables, such as Lipid profile, liver function, blood glucose, malaria parasitemia, zinc, foliate, and vitamin B levels, renal

function, hemoglobin concentration, and iron levels. Statistical significance set at a p-value of less than 0.05 was used to determine the level of significant differences between the variable parameters across the states.

Results and Discussions

Socio-economic characteristics of the subjects

This study evaluated the nutrition and health status of pregnant women in third trimester with malaria in rural communities in south eastern states in Nigeria. The information on the socio-economic characteristics showed that of the 400 participants, (46.3%) were within the age range of 25-30 years while 9.8% were below 20years, this may be attributed to the fact that women at this age are in the prime of their reproductive age. More than half (58.8%) of the respondents were married; this could be attributed to the fact that most of the participants were adults as such has reached the age for marriage. This is in agreement with the Nigerian average age for marriage (18 and above) reported by the human rights watch of ending child marriage in Nigeria 2018. Most of the respondents (68.3%) were Christians, (20.0%) were traditional/pagan while (11.8%) were muslims, this could be due to Christianity is the presiding religion in the locality. This is in agreement with the study of (Isaac. 2024) on religion and the Nigerian state: situating the de facto and the de jure frontiers of state-religion relations and its implications for national security.

Fifty-three (53%) percent of the respondents had secondary education while (16.3%) had primary education. This could be attributed to the high illiteracy rate in some rural area in the south east. Almost half (39.0%) of the respondent were business women while 24.5% were civil servant and 21.8% were farmers. This is due to unemployment rate in Nigeria which increased to 23.10 percent in the third quarter of 2018 from 22.70 percent in the second quarter of 2018. More than half (53.5%) of the respondents earned between #18,000 to #50,000 per month while a lesser while a lesser percentage earn less than #18,000 per month, this is attributed to the kind of commodity the sale and the capital involvement. This contradict the study by (Ahmad., 2013) on the household cost of antenatal care and delivery services in a rural community of Kaduna state, northwestern Nigeria.

Section: a

Variables	Frequency (N)	Percentage (%)
Age		
20yrs	39	9.8
20-25yrs	40	10.0
25-30yrs	18.5	46.3
30-35yrs	59	14.8
35-40yrs	39	9.8
40yrs	38	9.5
Total	400	100
Marital status		
Single	47	11.8
Married	235	58.8
Divorced	60	15.0
Widowed	58	14.5
Total	400	100.0
Religion		
Christainity	273	68.3
Muslim	47	11.8
Traditional/pagan	80	20.0
Total	400	100.0
How many children		
1	60	15.0
2	37	9.3
3	117	29.3
4	146	36.5
5	40	10.0
Total	400	100.0
Number of pregnancy		
1	58	14.5
2	39	9.8
3	58	14.5
4	59	14.8
5	186	46.5
Total	400	100.0
Gestational		
28weeks	67	16.8
29weeks	39	9.8
30weeks	59	14.8

31weeks	235	58.8
Total	400	100.0
Highest education attend		
Primary	67	16.8
Secondary	215	53.8
Tertiary	118	29.5
Total	400	100.0
Occupation		
Farmer	87	21.8
Civil servant	98	24.5
Business	156	39.0
Public servant	56	14.8
Total	400	100.0
Monthly income		
<18,000	28	7.0
18,000-50,000	214	53.5
50,000-100,000	60	15.0
100,000	98	24.5
Total	400	100.0
Ethnicity		
Yoruba	67	16.8
Igbo	215	53.8
Hausa	78	19.5
Others	40	10.0
Total	400	100.0

Table 1: Socio-economic data.

Section b

Source of carbohydrate		
Palm oil	195	48.8
Nuts	47	11.8
Rice	158	39.5
Total	400	100.0
Not a source of Vitamin A		
Cod-liver oil	243	60.8
Palm oil	59	14.8
Egg	40	10.0
Potatoes	58	14.5
Total	400	100.0
Infection could be caused by these except		
Eating contaminated food	147	36.8
Using dirty toilet	59	14.8
Drinking dirty water	136	34.0
Good hygiene practices	58	14.5
Total	400	100.0
Dirty water could increase the risk of having		
Malaria	157	39.3
Diarrhea	165	41.3
Cancer	78	19.5
Total	400	100.0
Is rich in energy		
Salt	47	11.8
Calcium	18	4.5
Iron	218	54.5
Sweet potatoes	117	29.3
Total	400	100.0
Could increase the risk of obesity in pregnancy		
Vitamins	59	14.8
Protein	67	16.8
Calories	254	63.3
Water	20	5.0
Total	400	100.0
Green leafy vegetable are good source of iron however		
Fat	59	14.8
Vitamin c	47	11.8
Vitamin k	78	19.5
Folate	216	54.0
Total	400	100.0
Which of these vitamins require fat for its absorption		
Vitamin a	195	48.8
Vitamin c	59	14.8
Vitamin b2	20	5.0
Vitamin b1	126	31.5
Total	400	100.0

Constipation during pregnancy can be ameliorated by		
Fibre	137	34.3
Vitamin e	47	11.8
Protein	216	54.0
Total	400	100.0
Fatty acid that is required for brain development		
Steric acid	67	16.8
Palmtic acid	118	29.5
Dha	20	5.0
Cholesterol	195	48.8
Total	400	100.0
Gestational diebetics could be managed by the intake of		
Vegetable	156	39.0
Soft drinks	126	31.5
Pastries	118	29.5
Total	400	100.0
Risk of high bp in pregnancy can be increased by		
Exercise	156	39.0
Consumption whole grain	79	31.5
High alcohol intake	165	29.5
Total	400	100.0
Adequate weight gain in pregnancy can be achieved by		
Exercise	321	80.3
Increase in fat intake	79	19.7
Total	400	100.0
Which lifecycle could help to maintain a healthy weight		
Sedimentary lifecycle	244	61.0
Physical activities	156	39.0
Total	400	100.0
Which of the following is not important		
Size of the pack	400	100.0
Total	400	100.0

Table 2: Nutritional knowledge.

Section c

It is not good for a pregnant woman to eat snail because		
Agree	233	58.3
Strongly agree	167	41.8
Total	400	100.0
Fruit and vegetable should be consumed daily		
Strongly agree	400	100.0
Total	400	100.0
It is ideal to exclusively breastfeed an infant for six		
Strongly agree	400	100.0
Total	400	100.0
Adequate complementary food should be introduce		
Agree	312	78.0
Strongly agree	88	22.0
Total	400	100.0
One has to eat for two during pregnancy for healthy pregnancy		
Agree	312	78.0
Strongly disagree	88	22.0
Total	400	100.0
Under nutrition during pregnancy does not pose risk		
Agree	312	78.0
Strongly disagree	88	22.0
Total	400	100.0
Infants under 6 month should be breast fed on demand		
Agree	167	41.8
Strongly agree	233	58.3
Total	400	100.0
It is good practice to eat different type of food each day		
Agree	79	19.8
Strongly agree	233	58.3
Disagree	88	22.0
Total	400	100.0
Food rich in fatty protein such as moi-moi		
Agree	79	19.8
Strongly	321	80.3

Total	400	100.0
Poor intake of iron rich food such as pumpkin		
Agree	79	19.8
Strongly agree	321	80.3
Total	400	100.0
Fruit and vegetable are essential for good health		
Agree	79	19.8
Strongly agree	321	80.3
Total	400	100.0
Improper washing of fruit and vegetable		
Agree	79	19.8
Strongly agree	321	80.3
Total	400	100.0
It is necessary to cook meat and fish property before		
Agree	79	19.8
Strongly agree	233	58.3
Disagree	80	22.0
Total	400	100.0
Intake of routine drugs vitamins and mineral supplements		
Agree	79	19.8
Strongly agree	77	19.3
Disagree	244	61.0
Total	400	100.0

Table 3: Nutritional attitude.

Health information of the respondents

The health information of the respondents revealed that 19.8% had history of diabetes in their other trimesters. This is gestational diabetes and it is due to insulin resistance by reason of change in the hormonal profile. Nineteen percent (19%) of the respondents had high blood pressure. This is due to overweight and obesity. This result contradicts other studies which showed that the prevalence of hypertension among pregnant women in second trimester is 6.29% (Ekeanyanwu., 2024). Only 5.0% of the respondents had preeclampsia. This is caused due to hypertension resulting from weight gain. This results disagrees with other studies which showed that the prevalence of preeclampsia among second trimester women in Africa was 10% (Alemaywhu., 2019). None of the respondents had proteinuria. This could be due to the low rate of high blood pressure and preeclampsia which would have temporarily impaired the kidneys ability to filter protein. This result contradicts other studies by Osama (2021) which showed that the prevalence of proteinuria in second trimester pregnancy was 10.7%. More than half 65.8% of the respondents had 3-4 numbers of children; this could be attributed to the age bracket of the mothers examined in this study who are still very young.

Section d

Any history of diabetes mellitus		
Yes	79	19.8
No	321	80.3
Total	400	100.0
Any history of blood pressure		
Yes	79	19.8
No	321	80.3
Total	400	100.0
Any history of HIV		
No	400	100.0
Total	400	100.0
Blood pressure measurement		
120/80	142	35.5
100/60	195	48.8
110/70	27	6.8
130/80	23	5.8
165/100	13	3.3
Total	400	100.0
Any history of preeclampsia		
Yes	20	5.0
No	380	95.0
Total	400	100.0
Any sign of protein in urine		
Yes	39	9.8
No	361	90.3
Total	400	100.0

Table 4: Health data.

Anthropometric data of the respondent

Nineteen percent (19%) of the respondents were overweight in the record of their first trimester assessment while 41.8% were overweight in their third trimester assessment. This could be due to the changing lifestyle such as consumption of diets high in sugar, fats and inactivity. This result disagrees with findings from other studies which showed that the rate of overweight among second trimester pregnancy in a developing countries was 10.7% (Biodun., 2015). High BMI is an indication of increased weight and possibly sedentary life style which are both risk factor of hypertension.

Age	**First**	
20-25	88	22.0
26-30	79	19.8
31-35	78	19.5
36-40	77	19.3
>41	78	19.5
Total	400	100.0
Height		
150	88	22.0
160	79	19.8
165	77	19.3
170	156	39.0
Total	400	100.0
Weight		
60	155	38.8
69	78	19.5
70	167	41.8
Total	400	100.0
Viscetal fat		
31	77	19.3
36	88	22.0
38	156	39.0
39	79	19.8
Total	400	100.0
Body fat		
23	166	41.5
24	78	19.5
25	79	19.8
27	77	19.3
Total	400	100.0
BMI		
Under-weight	78	19.5
Normal	243	60.8
Over-weight	79	19.8
Total	400	100.0
Muscle fat		
<50%	167	41.8
51-55%	78	19.5
56-60%	77	19.3
>61%	78	19.5
Total	400	100.0
Total body water		
<50%	167	41.8
51-55%	78	19.5
56-60%	77	19.3
>61%	78	19.5
Total	400	100.0
Age	**Second**	
20-25	88	22.0
26-30	78	19.8
31-35	78	19.5
36-40	77	19.3
>41	78	19.5
Total	400	100.0
Height		
150	88	22.0
160	79	19.8
161	77	19.3
170	156	19.5
Total	400	100.0
Weight		
60	155	38.8
69	78	19.5
70	167	41.8
Total	400	100.0
Viscetal fat		
31	77	19.3
36	88	22.0
38	156	39.0

39	79	19.8
Total	400	100.0
Body fat		
23	166	41.5
24	78	19.5
25	79	19.8
27	77	19.3
Total	400	100.0
BMI		
Under-weight	78	19.5
Normal	243	60.8
Over-weight	79	19.8
Total	400	100.0
Muscle fat		
<50%	167	41.8
51-55%	77	19.3
56-60%	78	19.5
>61%	78	19.5
Total	400	100.0
Age	**Third**	
20-25	88	22.0
26-30	79	19.8
31-35	78	19.5
36-40	77	19.3
>41	78	19.5
Total	400	100.0
Height		
150	88	22.0
160	79	19.8
161	77	19.3
170	156	39.0
Total	400	100.0
Weight		
60	155	38.8
69	78	19.5
70	167	41.8
Total	400	100.0
Viscetal fat	population	%
31	77	19.3
36	88	22.0
38	156	39.0
39	79	19.8
Total	400	100.0
Body fat		
23	166	41.5
24	78	19.5
25	79	19.8
27	77	19.3
Total	400	100.0
BMI		
Under-weight	78	19.5
Normal	155	38.8
Over-weight	167	41.8
Total	400	100.0
Muscle fat		
<50%	79	19.8
51-55%	166	41.5
56-60%	77	19.3
>61%	78	19.5
Total	400	100.0

Table 5: Section e: body composition assessment.

Secrum-vitamin a		**% Value**
31	77	19.3
33	88	22.0
36	78	19.5
38	78	19.5
41	19	19.8
Total	400	100.0
Serum ferritin		
59	78	19.5
61	77	19.3
62	88	22.0
67	78	19.5
90	79	19.8
Total	400	100.0
Heamoglobin		
12	78	19.5
14	79	19.8
14	78	19.5

14	77	19.3
15	88	22.0
Total	400	100.0
Serum zinc		
61	79	19.8
70	165	41.3
76	78	19.5
80	78	19.5
Total	400	100.0
Urinary iodine		
170	79	19.8
191	77	19.3
201	88	22.0
204	78	19.5
205	78	19.5
Total	400	100.0

Table 6: Section f: Biochemical Assessment.

Correlation of all parameters

A Pearson correlation was used to examine the relationship between the pregnant women in their third trimesters and lipid test. There was no meaningful linear correlation (0.022), between the third trimester women and lipid test. Lipid tests of pregnant women in their third trimester with Malaria has helped to monitor maternal and fetal health, as lipid levels naturally rise during this period and may influence pregnancy outcomes. Lipid profile tests during the third trimester can help establish pregnancy-specific reference ranges, identify risks for complications and monitor maternal cardiovascular health.

There was no meaningful linear correlation (0.069), between the pregnant women with malaria in their third trimester and inflammatory marker test. Inflammatory markers are substances in the blood that indicate the presence and intensity of inflammation. Inflammatory marker tests are not routine for all pregnant women but are often ordered when there are signs of preeclampsia, this is confirmed when the fetus shows signs of growth restriction, the mother has autoimmune conditions or infections and there's a history of preterm labor [4,5].

This result revealed that there was a very weak negative correlation (-0.049), and there's no meaningful relationship between the pregnant women with malaria in their third trimesters and liver function test. Liver function tests in the third trimester of pregnancy are crucial for detecting liver-related complications that can pose serious risks to both mother and baby, such as preeclampsia, HELLP syndrome, and intrahepatic cholestasis of pregnancy (ICP). Liver function tests measure enzymes, proteins and substances produced or processed by the liver (Nweke and Oguike, 2024).

There was a very weak negative correlation (-0.058), and there's no meaningful relationship between the pregnant women with Malaria in their third trimesters and hemoglobinopathies. Hemoglobinopathies in the third trimester of pregnancy can significantly impact maternal and fetal health, increasing the risk of complications such as preterm labor, fetal growth restriction, and maternal anemia. Careful monitoring and multidisciplinary management are essential. Pregnancy, especially in the third trimester, places increased demands on the maternal cardiovascular and hematologic systems. For women with hemoglobinopathies, this can lead to increased risk of maternal complications, preterm birth, low birth weight and perinatal mortality (Ministry of Health, 2020).

There was a very weak negative correlation (-0.045), and there's no meaningful relationship between the Pregnant women with malaria in their third trimesters and rapid diagnostic test. Rapid diagnostic tests in the third trimester of pregnancy are used to quickly detect infections or conditions that could affect the health of the mother or baby, such as group B streptococcus, HIV, syphilis, or covid-19. These tests help guide timely interventions before delivery. Rapid diagnostic test are especially valuable because they provide fast results during routine prenatal visits or labor, enable immediate treatment and reduce the risk of transmission of infections to the baby.

There was a very weak negative correlation (-0.033), and there's no meaningful relationship between the assessed pregnant women with Malaria in their third trimesters and renal function test. Renal function test in the third trimester of pregnancy are essential for monitoring kidney health, detecting complications like preeclampsia or acute kidney injury and ensuring safe outcomes for both mother and baby. Renal function assesses how well the kidneys are filtering waste and maintaining fluid and electrolyte balance [4].

There was a very weak negative correlation (-0.070), and there's no meaningful relationship between the pregnant women with malaria in their third trimesters and hemoglobin. In the third trimester of pregnancy, hemoglobin levels are crucial: both low and high concentrations can pose risks to maternal and fetal health. Pregnant women in their third trimester are routinely tested for hemoglobin levels to monitor for anemia, which can affect both maternal and fetal health. Maintaining adequate hemoglobin is crucial for oxygen delivery to the baby and the mothers organs [10].

There is a very strong meaningful linear correlation = 0.233** at ($p < 0.01$) between the pregnant women in their third trimesters and blood glucose. Pregnant women in their third trimester may undergo blood glucose testing to monitor or manage gestational diabetes, a condition that can develop during pregnancy and affect both mother and baby if left untreated [6].

There is a meaningful linear correlation =0.115* at ($p < 0.05$) between the pregnant women in their third trimesters with malaria and malaria parasite. Pregnant women in their third trimester are at increased risk of malaria-related complications, making malaria parasite testing essential for timely diagnosis and treatment to protect both mother and baby [4].

There was a very weak negative correlation (-0.041), and there's no meaningful relationship between the assessed pregnant women in their third trimesters and zinc levels. zinc levels naturally decline during the third trimester of pregnancy due to increased fetal demands and physiological changes, making adequate zinc intake crucial for maternal health and fetal development [10].

There was no meaningful linear correlation (0.006), between the Pregnant women with malaria in their third trimester and blood smear examination. In the third trimester of pregnancy, blood smear examinations are not routine but may be used to investigate specific concerns such as anemia, infections or blood disorders. A blood smear examination is important if the woman has unexplained fatigue, pallor or jaundice, signs of preeclampsia and a history of blood disorders or autoimmune conditions [5].

There was a very weak negative correlation (-0.072), and there's no meaningful relationship between the pregnant women with malaria in their third trimesters and red blood cell, red blood cell (RBC) test are crucial for monitoring maternal and fetal health, primarily to detect and manage anemia, which is common during this stage. During the third trimester, a woman's blood volume increases significantly to support the growing fetus. This can dilute red blood cells leading to physiological anemia of pregnancy [10].

There was no meaningful linear correlation (0.048), between the pregnant women with malaria in their third trimester and liver function test. Liver function tests in the third trimester of pregnancy are essential for detecting liver-related complications that can pose serious risks to both mother and baby such as preeclampsia, HELLP syndrome, and intrahepatic cholestasis of pregnancy (ICP) [5].

There was a very weak negative correlation (-0.032), and there's no meaningful relationship between the pregnant women with malaria in their third trimester and foliate. Foliate testing in the third trimester of pregnancy helps assess maternal foliate status, which is crucial for red blood cell production and fetal development, especially in high-risk pregnancies or when anemia is suspected [5].

There was no meaningful linear correlation (0.021), between the pregnant women with malaria in their third trimester and fecal occult blood test. Fecal occult blood tests are not routinely performed during the third trimester of pregnancy, but they may be used selectively to investigate unexplained gastrointestinal symptoms such as rectal bleeding, anemia, or suspected gastrointestinal pathology. A fecal occult blood test checks for hidden blood in the stool, which may indicate gastrointestinal bleeding, colorectal cancer or polyps, hemorrhoids, inflammatory bowel disease and diverticulosis [5].

There was no meaningful linear correlation (0.034), between the pregnant women with malaria in their third trimester and vitamin B12. Vitamin B12 testing in the third trimester of pregnancy is not routine but may be important when there are signs of anemia, neurological symptoms or risk factors for deficiency. Maintaining adequate b12 levels supports maternal health and fetal neurological development [9,12].

There was no meaningful linear correlation (0.018), between the pregnant women with malaria in their third trimester and iron

level. Pregnant women in their third trimester often experience a significant drop in iron levels due to increase demands from both the mother and the growing fetus. This makes maintaining adequate iron stores crucial to prevent anemia and support healthy development [4,5,11].

	Weeks	Lipid test	Inflammatory maker tests	Liver function test	Heamoglobin-opathy	Rapid diag-nostic test
Weeks	1 400	.022 .660 400	.027 .591 400	.012 .812 400	.047 .354 400	.032 .523 400
Lipid test	.022 .660 400	1 400	.069 .165 400	-.187** .000 400	.176** .000 400	.034 .502 400
Inflammatory maker tests	.027 .591 400	.069 .165 400	1 400	-.049 .332 400	.011 .831 400	-.010 ..840 400
Liver function test	.012 .812 400	-.187 .000 400	-.049 .332 400	1 400	-.058 .249 400	-.043 .386 400
Heamoglobin-opathy	.047 .354 400	.176** .000 400	.011 .831 400	-.058 .249 400	1 400	-.045 .364 400
Rapid diagnos-tic test	.032 .523 400	.034 .502 400	-.010 .840 400	-.043 .386 400	-.045 .364 400	1 400

Table 7: Correlation of all parameters.

**. Correlation is significant at the 0.01 level (2-tailed).

	Weeks	Renal function test	Hemoglobin	Blood glucose	Malaria parasite test	Zinc
Weeks	1 400	-.033 .506 400	-.009 .862 400	.001 .984 400	.006 .899 400	.007 .891 400
Renal function test	-.033 .506 400	1 400	-.070 .165 400	.175** .000 400	.029 .559 400	.055 .276 400
Heamoglobin	-.009 .862 400	-.070 .165 400	1 400	-.233** .000 400	.028 .577 400	-.061 .221 400

Blood glucose	.001 .984 400	.175** .000 400	-.233** .000 400	1 400	.115* .022 400	.030 .552 400
Malaria parasite	.006 .899 .400	.029 .559 400	.028 .577 400	.115* .022 400	1 400	-.041 .415 400
Zinc	.007 .891 400	.055 .276 400	-.061 .221 400	.030 .552 400	-.041 .415 400	1 400

Table 8: Correlation of all parameters.

**. Correlation is significant at the 0.01 level (2-tailed).

	Weeks	**Blood smear**	**Red blood cell**	**Liver function**	**Foliate**
Weeks	1 400	-.006 .899 400	.013 .799 400	.001 .976 400	.005 .926 400
Blood smear	-.006 .899 400	1 400	-.072 .153 400	-.025 .620 400	.010 .848 400
Red blood cell	.013 .799 400	-.072 .153 400	1 400	.048 .341 400	-.036 .475 400
Liver function test	.001 .976 400	-.025 .620 400	.048 .341 400	1 400	-.032 .517 400
Foliate	.005 .926 400	.010 .848 400	-.036 .475 400	-.032 .517 400	1 400

	Weeks	**Fecal octal blood count**	**B12**	**Iron**
Weeks	1 400	.021 .679 400	.027 .591 400	-.055 .270 400
Fecal. Octal blood count	.021 .679 400	1 400	.034 .496 400	-.035 .485 400
Vit B12	.027 .591 400	.034 .485 400	1 400	.018 .716 400
Iron	-.055 .270 400	-.035 .485 400	.018 .716 400	1 400

Table 9: Correlation of all parameters.

Conclusion and Recommendation

The present study has really shown that a high number of the pregnant women with malaria in their third trimester are overweight. Majority of the women relied on carbohydrate food because of availability while some food was avoided because of lack of nutritional information and body reactions. Also most of these pregnant women with malaria in their third trimester use uncovered water containers which can be used as habitants and breeding place for mosquitoes. Many of the pregnant women do not have mosquito net because they did not get it when it was distributed in the communities while some that had the net do not sleep in the net because they do not feel comfortable in the net. Moreso, study also showed that some of the women subjects skip meal, this was because most of the women are traders; they get so busy that they postpone their meal time. Also some of the women skipped meal to avoid being overweight and the baby getting too fat. The importance of making available, use of Insecticide-Treated Nets (ITNs), and keeping a clean environment so as to prevent mosquito bites and breeding should be stressed to pregnant women in the course of antenatal care. Proper nutrition education should be given to pregnant women in the course of antenatal care, to reduce overweight and obesity.

Acknowledgement

We the team of researchers gratefully appreciate Tertiary education trust fund (TETFUND) for making it possible through the Funding of this research. We are thankfull for this support and we say that all your effort to make this research possible will never be taken for granted.

We thank all the health practitioners who partnered with us to see that the research data collection went well. Furthermore, the research assistants, all lab analysts, all recruited for the purpose of this research for their active participation.

Thanks to all the pregnant mothers with malaria in their third trimester for maximum cooperation irrespective of their unstable physiological conditions. A million thanks to my Institution based Tetfund Directors, coordinators, and all in that team for maximum cooperation and encouragement towards the success of this research.

We are also grateful to the Journal ActaScientific.com (Acta Scientific Womens Health Publishers) for timely Publication.

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