

# PREVALENCE OF ANAEMIA IN PREGNANT WOMEN ATTENDING ANTENATAL CARE AT A TERTIARY HOSPITAL IN NORTHERN NIGERIA.

Raji Gomina Abdullahi<sup>1</sup>, Usman Abba<sup>2</sup>, Sule Yakubu Omeiza<sup>3</sup>, Abdulgafar Lekan Olawumi<sup>4</sup>, Bukar A Grema,<sup>4</sup> Abdulkareem Alhaji Yusuf<sup>4</sup>

<sup>1</sup>Yobe State Specialist Hospital Buni Yadi/ Yobe State University, Damaturu-Nigeria.

<sup>2</sup>Yobe State Specialist Hospital, Damaturu-Nigeria.

<sup>3</sup>National Orthopaedic Hospital Dala, Kano-Nigeria.

<sup>4</sup>Aminu Kano Teaching Hospital, Kano-Nigeria.

**Corresponding author:** Dr. Raji Gomina Abdullahi: ([gominabdul@gmail.com](mailto:gominabdul@gmail.com))

## ABSTRACT

**Background:** Anaemia in pregnancy is a common problem in developing and developed nations. It is one of the major causes of maternal mortality and morbidity across the globe especially in the developing countries. Hence, this study aimed to determine the prevalence and severity pattern of anaemia among pregnant women in northern Nigeria.

**Methods:** In this hospital-based cross-sectional study, 229 pregnant women were systematically selected from April to July 2021 at antenatal care clinic of the Obstetrics and Gynaecologic department of the hospital. An interviewer-administered questionnaire was used to collect data on Socio-demographic, antenatal profile, maternal cultural practices, lifestyle practices, clinical examination and laboratory parameters of the participants. Data were analysed using descriptive statistics.

**Results:** A total of 229 pregnant women were recruited in the study. The prevalence of anaemia was 31.9%, with 66%, 27% and 7% having mild, moderate and severe anaemia respectively. Based on red blood cell morphologic classification of anaemia, 82% of the anaemic pregnant women had microcytic anaemia, 17% had normocytic, and 1% had macrocytic anaemia.

**Conclusion:** This study revealed a high prevalence of anaemia in pregnancy, classifying it as a moderate public health problem. To address this, comprehensive antenatal care is recommended, including proper hygiene practices, deworming, malaria prophylaxis, appropriate use of haematinics, and the use of insecticide-treated nets.

**Keywords:** pregnant women; prevalence and pattern, anaemia, northern Nigeria

**Cite this article:** Raji GA, Abba U, Omeiza SY, Olawumi AL, Grema BA, Yusuf AA. Prevalence of anaemia in pregnant women attending antenatal care at a tertiary hospital in northern Nigeria. Yob Med J.2025;1(1):67-77

**Received:** 30-Dec-2024

**Accepted:** 08-Apr-2025

**Published:** 12-Apr-2025

## INTRODUCTION

Anaemia in pregnancy is a global health problem and one of the commonest medical conditions in pregnancy.<sup>1</sup> It is an important cause of maternal as well as perinatal morbidity and mortality, especially in low-income countries.<sup>1</sup> Primary health care Physicians are the first contact Physician in the community who can play a very important role in identification and treatment of anaemia.<sup>2</sup> Many issues associated with anaemia can be assessed and modified at the primary care level. Availability of local data on the magnitude and related predictors has a significant role in managing and preventing anaemia in pregnancy. Given the morbidity and mortality associated with anaemia in pregnancy, more research is needed on its current burden in Kano state. Anaemia occurs at all life cycle stages, but pregnant women and young children, especially preschool, are the most vulnerable.<sup>1</sup> Pregnancy as a physiological state may increase the burden of anaemia because of the dilution effect of the pregnancy, changes in the immune system associated with pregnancy, and increased susceptibility to some of the aetiological factors.<sup>3</sup> Anaemia is a medical condition in which the red blood cell number or their oxygen-carrying capacity is inadequate to meet physiologic needs. It is traditionally described as a haemoglobin (Hb) value that is less than two standard deviations below the median value for a healthy matched population by age, sex, altitude, and pregnancy status.<sup>4</sup>

World Health Organization (WHO) defines anaemia in pregnancy as haemoglobin (Hb) of less than 11g/dl or haematocrit concentration of less than 33% in peripheral blood in any stage of pregnancy, while Centres for Disease Control and Prevention (CDC) defines anaemia as pregnancy haemoglobin less than 11 g/dl or haematocrit of less than 33% in the first and third trimester and less than 10.5 g/dl or haematocrit of < 32.5% in the second trimester.<sup>1, 5</sup> According to WHO, during pregnancy, anaemia may be classified into three levels of severity: mild anaemia (Hb) levels 9 to 10.9g/dl), moderate anaemia (Hb 7 to 8.9b/dl), and severe anaemia (Hb drops less than 7g/dl).<sup>6</sup> Anaemia is under-reported in most

developing countries, even though it is one of the most prevalent public health problems and has serious consequences for national development.<sup>7</sup> Globally, anaemia affects about 1.62 billion people, of which 56 million are pregnant women.<sup>8</sup> Global data estimated the prevalence of anaemia in pregnancy in high-income countries to be 14% and 56% in low-income countries.<sup>9,10</sup> Anaemia in pregnancy shows remarkable continental variations; sub-Saharan Africa shows 57% prevalence, South-east Asia 48%, and south America 24.1%<sup>9,10</sup> The wide variations in the prevalence rates might be due to differences in aetiological factors, socio-demographic characteristics, lifestyles, and health-seeking behaviour across different cultures.<sup>9,10</sup>

It varies from region to region in Nigeria, with a reported prevalence of 36.2% in Anambra and 39.2% in Sokoto.<sup>11,12</sup> Of these, 90% have a nutritional Iron deficiency as the cause of anaemia in pregnancy.<sup>11,12</sup>

## METHODOLOGY

### Study site and population:

The cross-sectional study was conducted at the Obstetrics and Gynaecologic Antenatal care (ANC) clinic of Aminu Kano Teaching Hospital (AKTH), Kano. It is a 700 beds capacity hospital and serves as a referral center to the neighboring states. Patients in ANC are seen by Consultants, O&G residents and Family Medicine residents on O&G posting. Based on the hospital record, an average of 400 pregnant women are seen weekly in ANC clinic.

All pregnant women age 15-49 years who attended the Obstetrics and Gynaecologic ANC clinic of AKTH during the study period (April and July 2021) were recruited for the study. Pregnant women who required emergency care such as severe preeclampsia, antepartum haemorrhage, severe asthmatic attack and diabetic complications were excluded from the study. Pregnant women who had a recent history of blood transfusion (within the past three months) were also exempted from the study.

### Sample size estimation

A sample size of 229 was estimated using the Cochran formula<sup>13</sup>  $n = Z\alpha^2 pq/d^2$  where;  $n$  = minimum sample size,  $Z\alpha$  = standard normal deviate corresponding to a 5% level of significance (1.96),  $P$  = (prevalence rate of 17% for anaemia in pregnancy obtained from a similar study).<sup>14</sup>

$q = 1-p$  (83%), proportion of pregnant women without anaemia.  $d$  = level of precision which was set as 5%. Anticipated response rate was 90%.

### Sampling technique

A systematic random sampling technique was used to recruit consenting 229 pregnant women attending the ANC Clinic over 12 weeks. The Obstetrics and Gynaecology ANC Clinic were run four days in a week, and on each clinic day, an average of 100 pregnant women were seen. Therefore, an average of 400 women were seen every week ( $100 \times 4$ ). The sample frame was ( $400 \times 12$ ) over the proposed study period of 12 weeks = 4,800 and the sampling interval was  $4,800/229 = 21$ . At the beginning of the study, the first participant was randomly chosen from the first 21 pregnant women by balloting, in which they were told to pick from 21 scrolled paper with only one "yes". The patient that picked "yes" was taken as the first participant, thereafter every 21st pregnant women were recruited if she satisfied the inclusion criteria. Patients who did not meet the inclusion criteria were skipped, and the next participant before them was recruited. An average of 5 participants were recruited each day, and 20 patients were recruited each week over the study period of 12 weeks.

### Study protocol

Two research assistants were trained for this study. A face-to-face interview using a semi-structured pre-tested interviewer-administered questionnaire in English and Hausa languages were given to each participant to collect data on sociodemographic characteristics.

A venous blood sample were taken, for measuring full blood count using automated haematology analyser.<sup>35</sup> A drop of blood was placed on new slide, and thin smear was prepared. After being air-dried, labeled with identification number, the smear of the slide was fixed with

absolute methanol and the smear was stained with Giemsa solution based on the standard operational procedures (SOPs) and examined at  $10\times$  and  $100\times$  microscopic objectives.<sup>35</sup>

Anaemia in pregnancy was defined as packed cell volume PCV of less than 30%.<sup>35</sup> Based on the severity, women were classified into mild (PCV 27- 29%), moderate (PCV 19- 26%) and severe (PCV below 19%) regardless of their gestational age.<sup>35</sup> Manufacturer references was used to define mean corpuscular volume (MCV),  $< 80$  FL (microcytic anaemia), MCV 80- 100 FL (normocytic anaemia) and MCV  $> 100$  FL (macrocytic anaemia). Mean corpuscular haemoglobin (MCH)  $< 27$ pg and mean corpuscular haemoglobin concentration (MCHC)  $< 32$ g/dl for hypochromic anaemia.<sup>35</sup> Red cell distribution width (RDW)  $> 15\%$  indicate high RDW, and this is usually seen in microcytic and macrocytic anaemia. White cells count of  $< 4 \times 10^9/L$  or  $> 11 \times 10^9/L$  might be seen in infection. Platelet count cell  $< 120 \times 10^9/L$  indicate thrombocytopenia which can occur in haemolytic and haemorrhagic causes of anaemia in pregnancy.

### Ethical considerations:

IRB board name: Research Ethical Committee of Aminu Kano Teaching Hospital

Approval number: No.

NHREC/28/01/2020/AKTH/EC/2931

Date of approval: 20/11/2020.

The procedures of the research adhered to the ethical guidelines of the Declaration of Helsinki such that informed consent was obtained from each participant before recruitment into the study. Taking part in this research study was voluntary.

### Data analysis

The data obtained were collated, coded and filtered in the excel spread sheath before exporting into the IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp. This was to correct errors such as double entry and wrong values before analyses. Quantitative variables such as age, and PCV were described using measure of central tendency (mean, median) and measures of dispersion (range, standard deviation) as appropriate. Other quantitative variables like partner's age, household income, and number of deliveries were re-categorised into groups and were summarised

into frequencies and percentages. Similarly, categorical variables such as marital status, religion and tribe were summarised into frequencies and percentages. Data were presented in the form of charts or tables as appropriate.

### RESULTS

A total of 229 respondents completed the study (100% response rate). The age of the participants ranged from 18 to 49 years and the mean age was 29.17 (SD± 6.133) years. The majority of the participants, 27.9% belonged to the age group 25– 29 years. Most of the participants 84.3% resides within the urban area while 15.7% resides in the rural area. There was preponderance of Muslims (86.0%) in the study. The majority of

the participants were Hausa 52.4%, followed by Fulani 22.7%, Yoruba 4.4% and Igbo 7.0%. Other ethnic groups constituted the remaining 13.5%.

Two participants (0.9%) had no form of education, 6 (2.6%) had only 5 (2.2%) had primary education, 87 (38.0%) had secondary education, while 129 (56.3%) had tertiary education. Of the 229 that were married, 76.4% were in a monogamous setting, while 23.6% were in a polygamous setting.

Other socio-demographic characteristics of the study participants are shown in table 1a and b below

Table 1a: Socio-demographic characteristics of the study participants (n = 229)

Characteristics	Frequency (n)	Percentage (%)
<b>Maternal age group (years)</b>		
15-19	7	3.1
20-24	49	21.4
25-29	64	27.9
30-34	60	26.3
35-39	34	14.8
40-44	11	4.8
45-49	4	1.7
<b>Residence</b>		
Rural	36	15.7
Urban	193	84.3
<b>Marital status</b>		
Married	229	100
<b>Religion</b>		
Islam	197	86.0
Christianity	32	14.0
<b>Tribe</b>		
Hausa	120	52.4
Fulani	52	22.7
Yoruba	10	4.4
Igbo	16	7.0
Others	31	13.5
<b>Family structure</b>		
Nuclear	170	74.2
Extended	59	25.8
<b>Family size</b>		
2-4	125	54.6
5-8	65	28.4
>8	39	17.0
<b>Family setting</b>		
Polygamous	54	23.6
Monogamous	175	76.4

Table 1b: Shows the socio-demographic characteristics of the study participants (n = 229)

Characteristic	Frequency(n)	Percentage (%)
<b>Partners occupation</b>		
Civil servant	116	50.7
Trading	49	21.4
Self employed	62	27.0
Farming	0	0.0
Unemployed	2	0.9
<b>House income (N)</b>		
<N25,000	19	8.3
N25,000-N50,000	83	36.2
N51,000-N75,000	46	20.1
N76,000-N100,000	26	11.4
>N100,000	55	24.0

<b>Maternal occupation</b>		
<b>Civil servant</b>	45	19.7
<b>Trading</b>	15	6.6
<b>Self employed</b>	52	22.7
<b>Farming</b>	1	0.4
<b>Unemployed</b>	116	50.6
<b>Partners education status</b>		
<b>None</b>	1	0.4
<b>Quranic</b>	1	0.4
<b>Primary</b>	3	1.3
<b>Secondary</b>	44	19.2
<b>Tertiary</b>	180	78.7
<b>Maternal educational status</b>		
<b>None</b>	2	0.9
<b>Quranic</b>	6	2.6
<b>Primary</b>	5	2.2
<b>Secondary</b>	87	38.0
<b>Tertiary</b>	129	56.3

The majority of the participant's partners, 116 (50.7%) were civil servants. This was followed by self-employed 62 (27.1%), and only 2 (0.9%) were unemployed. Most of the participants, 83 (36.2%), had a monthly household income of between N25,000-N50,000. Fifty-five participants, (24%) earned more than N100,000. Forty-six participants, (20.1%) earned between N51,000 to N75,000, 26 (11.4%) participant earned N76, 000 –100,000 and only 19 (8.3%) earned less than N25,000. Most of the participants, 116 (50.7%) were unemployed. This was followed by self-employed 52 (22.7%), civil servant 45 (19.7%), trading 15 (6.6%) and farming 1 (0.4%). Majority of the participants 78.7% had tertiary education while 22.3% below tertiary educational level. One hundred and

twenty-nine (56.3%) had tertiary education while 43.7% below tertiary educational level. The majority of pregnant women were multigravida 83 (36.2%), followed closely by Primigravida 81 (35.4%) and grand multigravida 65 (28.4%). The majority of the participants, 152 (67.7%), 155 (67.7%) and 124 (54.1%), had started Iron, folic acid, and SP respectively, before enrolling into the study. Most of the participants 67.7% used LLITN during the current pregnancy while 32.3% of the participants did not use.

Table 2a and 2b shows the feto-maternal characteristic of the women. One hundred and forty-two 142 (62.0%) participants started their ANC in the second trimester while 86 (37.6%) commenced their ANC in the third trimester. Seventy-four (32.3%) of the participants had inter-pregnancy of less than 18 months while 33.6% had inter-pregnancy interval of greater than 18 months. Majority of the participants reported no febrile illness in index pregnancy 79.9% while 20.1% reported febrile illness in the index pregnancy.

Most of the participants 93.4% had singleton foetus while 6.6% had multiple gestation.

Majority of the participants 70.7% reported no vagina bleeding in index pregnancy while 29.3% had vagina bleeding in index pregnancy.

Most of the pregnant participants 89.5% had no prior history of heavy menstruation while 10.5% had prior history of heavy menstruation. Majority of pregnant participants did not use contraceptives before pregnancy while 29.3% had used it in the past.

Table 2a: Feto-maternal characteristic of the study participants (n = 229)

Characteristic	Frequency(n)	Percentage (%)
<b>Time of initiation of ANC</b>		
Second trimester	143	62.4
Third trimester	86	37.6
<b>Iron tablet intake in current pregnancy</b>		
Yes	152	67.7
No	77	32.3
<b>Folic acid intake in current pregnancy</b>		
Yes	155	67.7
No	74	32.3
<b>SP taken during current pregnancy</b>		
Yes	124	54.1
No	105	45.9
<b>Sleep under LLITN</b>		
Yes	155	67.7
No	74	32.3
<b>Use of any birth control</b>		
Yes	67	29.3
No	162	70.7
<b>Vaginal bleeding during current pregnancy</b>		
Yes	18	29.3
No	211	70.7
<b>Heavy bleeding during menstruation</b>		
Yes	24	10.5
No	205	89.5
<b>Recent febrile illness</b>		
Yes	46	20.1
No	183	79.9
<b>Inter-pregnancy interval</b>		
<18 months	74	32.3
≥18 months	77	33.6
<b>Primigravida</b>	78	34.1
<b>Multiple Gestation</b>		
Single	214	93.4
Multiple	15	6.6



**Table 2b: Feto-maternal characteristic of the study participants (n = 229)**

Characteristics	Frequency (n)	Percentages (%)
<b>Prior pregnancy loss</b>		
Yes	96	41.9
No	133	58.1
<b>Number of deliveries</b>		
None	72	31.5
1-4 times	118	51.5
≥5 times	39	17.0
<b>Number of children delivered alive</b>		
1-2	100	43.7
3-5	45	19.6
>5	7	3.1
None	77	33.6
<b>Number of male children alive</b>		
1-2	112	48.9
3-5	25	10.9
None	92	40.2
<b>Number of female children alive</b>		
1-2	101	44.1
3-5	34	14.8
None	94	41.1

Table 3 Shows the maternal cultural and dietary/lifestyle practices of the participants. The dietary pattern and nutritional assessment of the participants revealed that 155 (67.7%) had more than three times meal served per day while 74 (32.3%) had less than three times per day. The majority of participants, 129 (56.3%), took Meat/fish/egg more than three times per week, 90 (39.3%) took 1 – 2 times per week, while 10 (4.3%) reported not taken it in a week. Among study participants, 118 (51.5%) took Vegetable/fruit three or more times per day, 97

(42.4%) took 1- 2 times per day while 14 (6.1%) did not take Vegetable/fruit per day in the index pregnancies. Most of the pregnant women, 125 (54.6%), did not report foods restriction during the index pregnancy, while 104 (45.4%) avoided different types of food during the index pregnancy. Only 1 (0.4%) reported cigarette smoking while the vast majority, 228 (99.6%), were non- smokers. The vast majority of the participants, 226 (98.3%), did not consume alcohol, while 3 (0.7%) took alcohol during the index pregnancy

**Table 3: Maternal cultural, and dietary/life style practices (n = 229)**

Characteristics	Frequency (n)	Percentages (%)
<b>Meals served per day</b>		
1-2 times	74	32.3
3 or more times	155	67.7
<b>Meat/fish/egg served per week</b>		
None	10	4.4
1-2 times	90	39.3
3 or more times	129	56.3
<b>Vegetable/fruit served per day</b>		
None	14	6.1
1-2 times	97	42.4
3 or more times	118	



Food items prohibited during pregnancy		
Yes	104	45.4
No	125	54.6
Smoking		
Yes	1	0.4
No	228	99.6
Alcohol		
No	3	1.3
Yes	226	98.7

Table 4 shows prevalence of anaemia in pregnancy. The overall prevalence of anaemia in this study was 31.9% and the mean PCV was 33.04 (SD± 6.774). This is presented in the table 5 below.

Table 4: Prevalence of anaemia in pregnancy (n= 229)

CATEGORIES	FREQUENCY	PERCENTAGE
ANAEMIC	73	31.9%
NON ANAEMIC	156	68.1%
TOTAL	229	100%

About two-thirds of anaemic participants, 48 (66.0%), had mild anaemia, followed by moderate 20 (27%) and severe anaemia 5 (7%), as illustrated in figure 1. Based on red blood cell morphologic classification of anaemia, of the total anaemic pregnant mothers, 60 (82%) had microcytic anaemia, 12 (17%) had normocytic, and 1% had macrocytic anaemia. This is presented in figure 2 below.

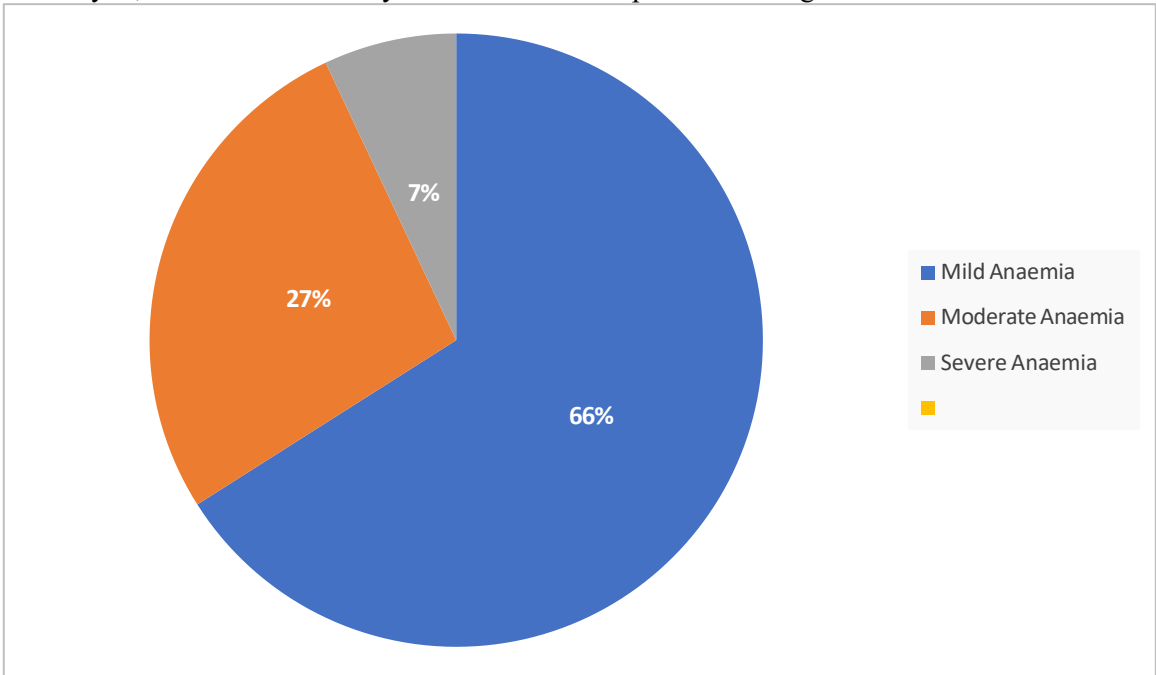
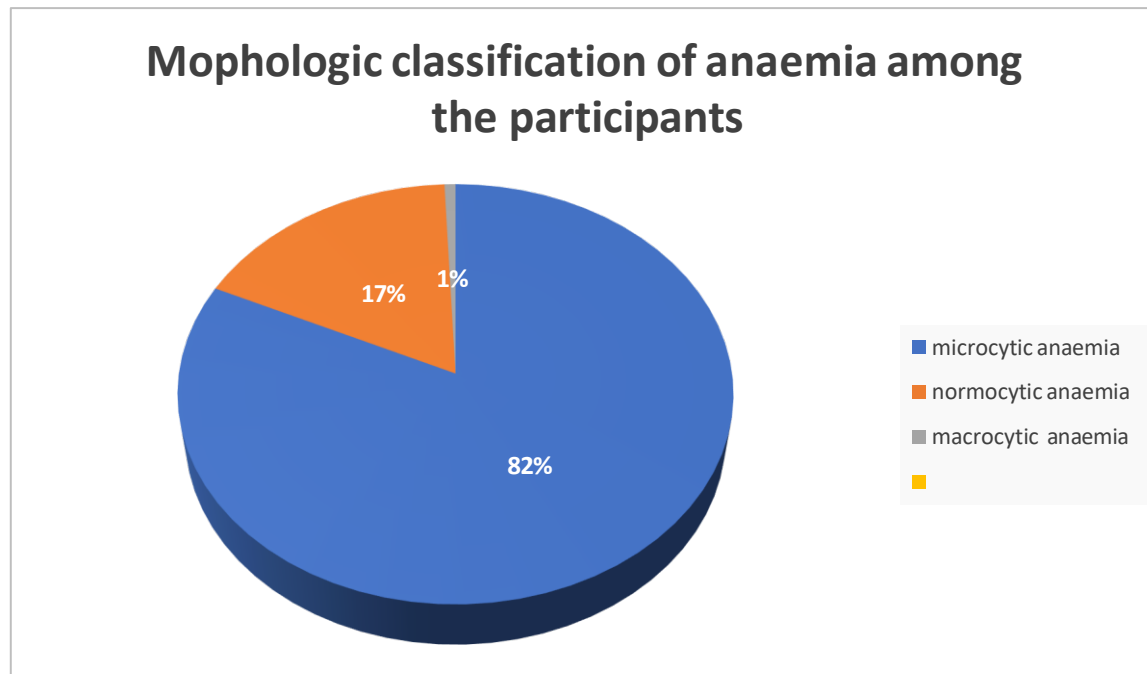


Figure 1: Pie chart showing the severity pattern of anaemia among the participants (n = 229)



**Figure 2: Pie chart showing the morphologic classification of anaemia among the participants (n = 229)**

### DISCUSSION

In this study, data from 229 participants were analysed. The ages of the participants ranged from 18 to 49 years. The mean age was 29.17 (SD± 6.133) years.

The prevalence of anaemia among pregnant women in this study was 31.9%. According to the WHO stratification of the public health importance of anaemia, this prevalence indicates a moderate public health significance of anaemia among pregnant women in this study.<sup>1</sup> This prevalence of anaemia is higher than, 17% reported in previous studies conducted in Kano 11 years ago by Nwizu *et al*<sup>14</sup> and 12.3% reported by Ajape *et al* in Lagos, South-West Nigeria.<sup>16</sup> The increase in prevalence observed in these studies might be due to worsening socioeconomic conditions in the last decade, likewise food insecurity caused by criminal activities in northern, Nigeria. However, this result is lower than 38 % reported by Victor *et al* in Warri and 45% reported by Idi *et al* in Yobe, North-eastern Nigeria.<sup>17,18</sup> The difference observed in this study and the one by Victor *et al* in Warri and Idi *et al*.

in Yobe, North-eastern Nigeria, may be attributed to militancy and insurgency and its adverse effects such as poverty and malnutrition. However, this rate is similar to the prevalence of 31.66% reported from a cross-sectional study by Bekele *et al* in Ethiopia<sup>19</sup> and 33% reported by Kofie *et al* in Ghana.<sup>20</sup> The similarities in the prevalence of anaemia in this study and that of Ghana and Ethiopia are not surprising because both are developing countries located in Africa continent with similar patterns of disease burden and socio-economic indices like our study.

This prevalence is lower compared to figures obtained in some other African countries such as Sierra Leone, 59.7%, and 63.1% in Burkina Faso.<sup>21,22</sup> This might be because Nigeria has better gross domestic product GDP and good health care facilities compared to these countries. The result of this study is lower than the global prevalence rate of 41.8% % for anaemia in pregnancy.<sup>8</sup> This might be due to the fact that majority of the participants in this study are urban dwellers with better socioeconomic status.

The severity pattern of anaemia noted in this study ranges from mild 66.0%, followed by moderate 27% and severe anaemia 7%. This finding better than a survey by Kefiyalew *et al* in South-east Ethiopia, who reported that, of the anaemic pregnant women, 55%, 32.5% and 12.5% had mild, moderate and severe anaemia, respectively.<sup>23</sup> This could be as a result of the fact that pregnant women on Iron supplementation and antimalarial prophylaxis were excluded from the study by Kefiyalew *et al*.<sup>23</sup> This might possibly alter the severity pattern of anaemia among the pregnant women in Kefiyalew's study compared to this study.<sup>23</sup>

In this study, the majority of the pregnant women with anaemia 82% had a microcytic red blood cell morphology, with 17% having normocytic and only 1% with macrocytic morphology. This contrast with the findings of a study by Bekele et al and Mortaz et al,<sup>19,24</sup> They reported that 97% of anaemic mother had normocytic red cells but in agreement with WHO finding, who reported that the majority of the pregnant mothers had microcytic anaemia.<sup>1</sup> The alteration in

morphological pattern reported by Mortaz *et al* might be due to the impact of haemodilution of pregnancy in the presence of low pre-pregnancy haemoglobin.<sup>24</sup> Furthermore, a high therapeutic drive with regard to a community with a high prenatal intake of Iron supplement in that study population by Mortaz *et al* may perhaps have contributed to this modified blood picture.<sup>24</sup>

**Limitation:** The hospital-based design of this study may not permit generalization of the findings to the community compared to the community-based research. Thus generalization should be made with caution.

**Conclusion:** Anaemia is a public health problem that affects populations in both developed and developing countries. This study reported a high prevalence of anaemia among pregnant women accessing antenatal care at Aminu Kano Teaching Hospital, Kano. Thus, this high prevalence is a cause of major concern. Large scale community based studies should be done to assess the related factors for anaemia among pregnant women attending ANC.

## REFERENCES

- Berhe B., Marddu, F., Legese, H., Gebrewahd A., Gebremariam G., et al. Prevalence of anemia and associated factors among pregnant women in Adigrat General Hospital, Tigray, northern Ethiopia, 2018. *BMC Res Notes*. 2019;12(1):310
- Sinha A, Adhikary M, Phukan JP, Kedia S, Sinha T. A study on anaemia and its risk factors among pregnant women attending antenatal clinic of a rural medical college of West Bengal. *J Family Med Prim Care*. 2021;10(3):1327-1331.
- Chandra A, Marsigit J, Pratiwi A, Akhmad R, Andrianus A, Priyatini T et al. Education and socioeconomic status as risk factors of anaemia in pregnancy: A cross-sectional study in Puskesmas Kecamatan Duren Sawit. *Advanced Science Letters* 2018;24(9):6526–6529.
- Stevens GA, Finucane MM, De-Regil LM. Global, regional, and national trends in haemoglobin concentration and prevalence of total and severe anaemia in children and 1995-2011: A systematic analysis of population-representative data. *Lancet Glob Health* 2013;1(1):16–25.
- Centres for Disease Control and Prevention. CDC criteria for anaemia in children and childbearing-aged women. *MMWR Morbidity and mortality weekly report*. 1989; 138(22):400–404.
- Al-Aini S, Senan C, Azzani M. Prevalence and associated factors of anemia among pregnant women in Sana'a, Yemen. *Indian J Med Sci*. 2020;72:1–6.
- Centres for Disease Control. Criteria for anaemia in children and childbearing aged women. *Morb Mortal Wkly Rep* 1989;38:400 - 417.
- Balarajan Y, Ramakrishnan U, Ozaltin E, Shankar AH, Subramanian SV. Anaemia in low-income and middle-income countries. *Lancet* 2015;378:2123-2135.
- Anthony W. Prevalence and determinants of anaemia in pregnant women receiving antenatal care at a tertiary referral hospital in Northern Ghana. *BMC Pregnancy and Black RE*, Victoria CG, Walker SP. Maternal and child undernutrition and overweight in low-income and middle-income countries. *The Lancet* 2013; 382(9890):427–451.
- Oguizu AD, Orjiekwe OA. Assessment of anaemia in pregnant women attending antenatal care in medical facilities within Ekwulobia, Aguata Local Government Area, Anambra State Nigeria. *J Food Sci Nutr*. 2018;1(3):26-30
- Buhari H, Imoru M, Erhabor O. Anaemia in pregnant women of Sokoto Residents in North-Western Nigeria. *J Blood Disord Transfus*. 2017;7(5):366.
- Araoye OM. Subject selection. *Research methodology with statistics for health and social sciences*. 1st Edition Nathadex Publishers Ilorin 2004; 6: 115-120
- Nwizu EN, Iliyasu Z, Ibrahim SA, Galadanci HS. Socio-demographic and Maternal Factors in Anaemia in Pregnancy at Booking in Kano, Northern Nigeria. *Afr J Reprohd Health* 2011;15(4):33-41.
- Dattijo ML, Daru PH, Umar NI. Anaemia in pregnancy: Prevalence and associated factors in Azare, North-east Nigeria. *IJTDH* 2016; 11(1): 2-9
- Ajepe AA, Okunade KS, Sekumade AI, Daramola ES, Beke MO, Ijase O, et al. Prevalence and foetomaternal effects of Iron deficiency anaemia among pregnant women in Lagos, Nigeria. *PLoS ONE* 2020; 15(1): 2 -13.
- Victor O, Henry A. U, Nathaniel B, Emmanuel K, Joel R. Ua, Akafa R. et al. Prevalence, severity, and correlates of anaemia in pregnancy among Antenatal attendees in Warri, South-Southern Nigeria: A cross-sectional and hospital-based study. *Anaemia*, 2020:3–7
- Idi HT, Awwalu S, Abjah U, Babadoko AA, Mamman AI, Waziri AD, et al. Prevalence of anaemia among pregnant women attending ante-natal clinic in a tertiary health-care facility: A study in an area under insurgency in North-eastern Nigeria. *Ann Trop Pathol*. 2019;10: 59-62.
- Bekele E, Alem M, Gelaw A, Kena T, Seid M, Olkeba Y. Prevalence of anaemia and associated risk factors among pregnant women attending antenatal care in Azezo Health Center Gondar town, North-west Ethiopia. *J Interdiscipl Histopathol* 2013;1(3):137–144.
- Kofie P, Elvis ET, Emmanuel M, Hubert A, Martin A, Fortress YA et al. Prevalence and associated risk factors of Anaemia among women attending antenatal and post-natal clinics at a public health facility in Ghana. *BMC Nutrition* 2019; 5: 40
- Fredanna A, Cormack MC, Judy C D. Assessment of anaemia knowledge, attitudes and behaviors among pregnant women in sierra leone. *The health Educator* 2013;44(2):9-15.

20.

21. WHO. 11 Special subjects; causes of death. Anaemia. World health statistics quarterly 2015;15: 594

22. Kefiyalew F, Zemene E, Asres Y, Gedefaw L. Anaemia among pregnant women in Southeast Ethiopia: pregnant and non-pregnant women for Childbirth 2019;19:495

prevalence, severity and associated risk factors. BMC Res Notes 2014; 7: 771.

23. Mortaz RE, Ahmed MU, Sultana A. Pattern of anaemia during pregnancy among patients in selected hospital in Bangladesh. MOJ Public Health. 2015;2(4):108–110.