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Assessing anaemia preventive measures' effectiveness among pregnant women using haemoglobin concentration pattern

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Abstract
Background: Maternal anaemia is related to poor pregnancy outcome, with adverse effects on the mother and foetus, which can be ameliorated if adequate anaemia preventive measures are instituted.
Objectives: The study assessed the effectiveness of anaemia preventive measures through the estimation of haemoglobin concentration pattern.
Methods: A cross-sectional study was conducted. The participants were 410 pregnant women aged ≥18 years, booking for antenatal care at a gestational age (GA) ≤24 weeks. The recruitment spanned 29 weeks, from January to July 2023. Their haemoglobin (Hb) at booking was estimated and they received anaemia preventive measures such as health talks/dietary advice, haematinics, anthelminthics and intermittent preventive treatment for malaria. Subsequently, their Hb were measured at 24-, 28-, 32- and 36- weeks GA. Data was analyzed with SPSS version 25 and a *P*-value <0.05 was considered significant.
Results: There were 410 participants, 136 (33.2%) were anaemic at booking. Of these 130 (31.7%) had mild anaemia (Hb 9.0 - 10.9g/dl), while 6 (1.5%) had moderate anaemia (Hb 7.0 - 8.9g/dl). The overall mean Hb at booking and 36 weeks varied little (11.34±1.31 and 11.27±0.77 respectively). However, the proportion of women with moderate anemia at booking steadily declined to zero by 32 weeks. Among the anaemic group at booking, there was a steady increase in the proportion that became not-anemic from 15.4%, to 19.1%, to 31.6% and 44.1% at 24-, 28-, 32-, and 36- weeks respectively. The differences in the proportions were statistically significant (p=0.0001). Conversely, for the not-anemic at booking, 21.9% developed anaemia by 36 weeks.
Conclusion: The prevalence of anaemia at booking was 33.2%. Preventive measures were effective in eliminating moderate anaemia and reversing a good proportion of mild anaemia. Despite these measures some not-anemic women subsequently developed anaemia. Generally, there was a positive relationship between Hb pattern in pregnancy and preventive measures use.

Keywords: Anaemia in pregnancy, haemoglobin concentration, prevalence, preventive measures

Introduction
Maternal anaemia is related to poor pregnancy outcome, with adverse effect on the life of the mother and foetus. The World Health Organization (WHO) defines anaemia in pregnancy as a haemoglobin concentration less than 11 g/dl and estimates that more than half of pregnant women in developing countries have a haemoglobin level indicative of anaemia; they classified anaemia as mild, moderate, and severe when the haemoglobin level is 9 - 10.9 g/dl, 7 - 8.9 g/dl, <7 g/dl respectively [1].
World Health Organization data indicate that iron deficiency anaemia is a significant problem throughout the world ranging from 1% - 14% in the industrialized countries to an average of 56% in developing countries including Nigeria [2]. About 56- 61% of pregnant women in Nigeria have iron deficiency anaemia, according to the Nigerian National Demographic Health Survey in 2018 [3]. To prevent the development of iron deficiency, the WHO recommends universal oral iron supplementation for pregnant women (30-60 mg of elemental iron and 400 µg of folic acid daily) for six months in countries with prevalence of anaemia of less than 40% and for an additional 3 months postpartum in countries where the prevalence is more than 40% [4]. The equivalent of 60mg of elemental iron is found in 200mg of ferrous sulphate, 180mg of ferrous fumarate or 500mg of ferrous gluconate.

The WHO in 2004 outlined the management of anaemia using three levels of care; the primary, secondary and tertiary levels of care [4]. The primary (prophylactic) level of care involves assessment and identification of the women at risk of anaemia; these women are then educated on the causes and prevention of anaemia, promptly treated for infections like urinary tract infection and worm infestation, balanced diet rich in iron and protein (like liver, meat, eggs and green vegetables) are recommended, Folic acid and Iron supplementation are given, with intermittent preventive treatment for malaria prophylaxis (using sulphadoxine/pyrimethamine combination) [4]. Others are adjuncts like the use of insecticide treated net (ITN) to avoid mosquito bites and general hygienic practices, which are vital to reduce the prevalence of anaemia during pregnancy.

Antenatal care (ANC) creates an opportunity for risk factors detection, complications prevention and improved birth preparedness to reduce foetomaternal morbidity [5]. By implementing timely and appropriate evidence-based practices, antenatal care can indeed be lifesaving. The WHO has published widely accepted recommendations for ANC, [5, 6] which include suggestions for adequate contact (frequency and timing between clients and the health system) and content (screening and management) based on evidence of effectiveness. Facility-based documentation and direct observations can be used to assess effective coverage of ANC interventions at a given visit [7]. Anaemia detection, prevention and treatment is part of the core objectives of antenatal care. Antenatal health talks are a major vehicle by which information, education and communication is passed on to pregnant women.

The adverse outcome of anaemia in pregnancy can be ameliorated if adequate anaemia preventive measures are instituted. Describing the haemoglobin concentration pattern in pregnancy will serve as an audit to assess the effectiveness of the preventive measures of anaemia. The purpose of this study, therefore, was to assess the effectiveness of anaemia preventive measures through the estimation of haemoglobin concentration pattern throughout pregnancy.

Patients/Methods

Study Site / Area

This study was conducted at the antenatal clinic of the Rivers State University teaching hospital (RSUTH) Port Harcourt, a tertiary hospital owned and funded by the Government of Rivers State of Nigeria. The hospital provides obstetric services to women referred from other centers, as well as providing antenatal care and delivery services for low and high-risk pregnant women booked with the hospital. Port-Harcourt is a state capital, a metropolitan oil rich city, and made up of multi-ethnic and multicultural residents. Port Harcourt is predominately Christian, as is most of Southern Nigeria. The average daily attendance at the antenatal clinic is about 70 women including 20 newly booked mothers, and the clinic runs from Monday through Friday. Ethical approval (RSUTH/REC/2022205) was obtained from the Research and Ethics Committee of the RSUTH before commencement of the study and a written informed consent was obtained from each participant.

Study Design and Population

This was a hospital-based cross-sectional study. The participants were 410 consecutive and consenting, low-risk pregnant women ≥18 years of age, booking for antenatal care at a gestational age (GA) ≤24 weeks. The recruitment spanned 29 weeks, from January to July 2023. Women who presented for booking at GA > 24weeks, having haemoglobinopathy, haemolytic anaemia, Chronic diseases (Retroviral disease, hypertensive disorders, liver & renal disease), multiple pregnancy, and women who refuse to give consent, were excluded.

A pilot study was conducted at Ozoboko health centre, which is about 5 km from RSUTH to test run the equipment and to review the communication skills required before the commencement of the study.

Sample Size Determination

The sample size was calculated using the formula for cross-sectional studies [8]:

$$n = \frac{Z^2\, pq}{e^2}$$

Where: n is the sample size required for the study. Z is 95% confidence interval i.e. the desired level of significance set at 95% equivalent to 1.96. p Is the working prevalence rate of anaemia of 60.3% as found in a previous study in RSUTH Port Harcourt,[9] using 11g/dl as cut-off for anaemia, hence P is 0.60. q is (1 - p), which is 1 - 0.60 = 0.40. e is margin of sampling error tolerated; 95% confidence interval set at 5% in this study (0.05).

Substituting: $n = \frac{1.96^2\, x\, 0.60\, x\, 0.40}{0.05^2}$, n = 369.

Allowing for attrition rate of 10% (37) the sample size was adjusted to 406.

Therefore, the minimum sample adopted for this study was 410 participants

Study Procedure / Recruitment

Pregnant woman who met the eligibility criteria and gave consent were recruited daily using a convenient sampling technique until the sample size was reached. A purposively designed proforma was used to collect sociodemographic data and record the haemoglobin concentrations estimated at booking and over the period of the study, which was updated at each contact till 36weeks GA. The folder of each participant was tagged for easy identification and recall. Their haemoglobin at booking was estimated and they received anaemia preventive measures such as health talks/dietary advice, haematinics, anthelminthics and intermittent preventive treatment for malaria. At subsequent visits, their haemoglobin levels were measured at 24weeks, 28weeks, 32weeks and 36weeks gestational ages.

Before the commencement of each antenatal clinic day, clients are usually addressed by health workers on different topics pertaining to pregnancy, labour and the puerperium. These talks are usually given by trained nurses and nutritionist, but for the purpose of this research, the dietary education was done by one of the researchers in conjunction with the hospital nutritionist. This included various harmful or unhealthy common nutrition practices, fads and taboos common in the area and the women discouraged against them. Emphasis was also laid on the various cooking methods with a view to preserving the nutritious content of food. A WhatsApp group was created, and participants added after recruitment, where messages were sent to remind them of the need to comply with all other anaemia preventive measures.

The participants received the full complement of ANC anaemia preventive strategies, such as health talks/dietary advice and

haematinics (Oral Fersolate as Ferrous Sulphate made by Pauco® Pharmaceuticals at a dosage of 200mg once daily and Folic acid made by Emzor® Pharmaceuticals at a dosage of 5mg once a day). They also received intermittent preventive treatment for malaria every 4 weeks (oral sulphadoxine 500mg and pyrimethamine 25mg (Malcidal©) made by Juhel® Pharmaceuticals) and anthelminthic (single dose of oral Mebendazole 500mg made by Janssen® Pharmaceuticals), both of which were administered by direct observed therapy. The last two were commenced after first trimester of pregnancy.

The importance of compliance with these antenatal measures was explained to the participants both at the start of the study and periodically during the group teaching sessions. They were encouraged to eat local foods that are rich in iron and protein (like plantain, snails, periwinkles, fish and vegetables) and advised not to overcook their food especially the vegetables.

Estimation of Haemoglobin Concentration Using the HemoCue®

The haemoglobin concentration of participants was measured using the HemoCue® system (HemoCue AB, Ängelholm, Sweden). The HemoCue system consists of a portable, battery-operated photometer and a supply of treated disposable cuvettes in which blood is collected. It utilizes capillary blood and gives satisfactory accuracy and precision when evaluated against standard laboratory methods.

After obtaining verbal consent from the participant, she was made to sit well relaxed on a chair. The hand was made warm, and the middle finger was disinfected with alcohol swab and allowed to dry. Using the thumb, the middle finger was lightly pressed from the distal interphalangeal joint towards the tip and the finger was pricked using a lancet. The first two drops of blood were wiped away and light pressure re-applied towards the fingertip until another drop of blood appeared. When the drop was large enough, the microcuvette was filled in one continuous process, ensuring that air bubbles were not trapped in the filled microcuvette. The filled microcuvette was then placed in the cuvette holder. The cuvette holder was then pushed to its measuring position. Testing was performed within 10 minutes from filling the microcuvettes and the haemoglobin value of the sample as displayed on the screen was recorded.

Data Analysis Methods

Coded data was entered into Microsoft Excel sheet and analyzed with SPSS (Statistical Package for Social Sciences) for Windows version 25 (SPSS Inc., Chicago, Illinois, USA). The data was presented in tables and figures as appropriate. Frequencies and proportions were used to present categorical variables. Summary statistics like mean, median, standard deviation and range were used in presenting numerical variables. Differences in proportions were compared for statistical significance using Pearson's chi square test. The mean differences between booking haemoglobin (Hb) concentration and haemoglobin concentration at 24-, 28-, 32 and 36 weeks among the study population was explored using a paired t-test. Pearson's correlation analysis was carried out to explore the relationship between the haemoglobin concentration and gestational ages at different points in the study. A p value < 0.05 was considered statistically significant.

Results

There were 410 participants, 136 (33.2%) of the participants at booking were anaemic, using haemoglobin concentration less than 11 g/dl as defined by WHO. Of these 130 (31.7%) had mild anaemia (Hb 9.0 - 10.9g/dl), while 6 (1.5%) had moderate anaemia (Hb 7.0 - 8.9g/dl). Two hundred and seventy-four (66.8%) were not anaemic. The mean Hb concentration of the study population at booking was 11.34±1.31, with median of 11.15 and range of 7.0 - 19 g/dl. Table 1 shows the distribution of the sociodemographic characteristics of the study population. Majority of the participants, 57.6% were aged 26 - 34 years, 98.0% were married, 77.3% had tertiary education, 95.6% were Christians and 61% were multiparous (Parity of ≥1). Also, majority of the women 83.2% booked for ANC in the second trimester (≥14 weeks GA), the rest registered early.

Table 1: Socio-demographic characteristics of the study population

Variables	Frequency	Percentage
Maternal age (years)		
≤25	47	11.5
26 - 34	236	57.6
≥35	127	31.0
Summary	Mean ± SD = 31.98±5.03	Median = 32. range = 21 - 46
Marital status		
Single	8	2.0
Married	402	98.0
Educational level		
Secondary	93	22.7
Tertiary	317	77.3
Religion		
Christianity	392	95.6
Islam	18	4.4
Parity		
Para 0	160	39.0
Para 1 or more	250	61.0
Summary	Median = Para 1	Range = Para 0 - 6

Table 2 shows the anaemia profile of the study population at the different assessment periods. The overall mean Hb of the participants at booking and 36 weeks varied little (11.34±1.31 and 11.27±0.77 respectively), however, the mean at booking showed the highest variability (SD±1.31) ranged from 7.0 - 19.0 g/dl than at 36 weeks (SD±0.77) ranged from 9.2 - 13.8 g/dl. The proportion of women with moderate anemia at booking 1.5% steadily declined to zero by 32 weeks GA. Those with mild anaemia at booking, however, increased from 31.7% to 45.4% at 24 weeks, to 48.3% at 28 weeks, before decreasing to 39.3% at 32 weeks and back to 31.7% at 36 weeks GA.

Table 2: Anaemia profile of the study population at the different assessment periods.

Haemoglobin profile	Frequency	Percentage
Level of Hb conc. at booking		
Moderate anaemia (7.0 - 8.9g/dl)	6	1.5
Mild anaemia (9.0 - 10.9g/dl)	130	31.7
Not anaemic (≥11.0g/dl)	274	66.8
Mean Hb conc.± SD; Median (range)	11.34±1.31;	11.15 (7.0 - 19.0)
Level of Hb conc. at 24 weeks		
Moderate anaemia (7.0 - 8.9g/dl)	5	1.2
Mild anaemia (9.0 - 10.9g/dl)	186	45.4
Not anaemic (≥11.0g/dl)	182	44.4
Lost to follow-up	37	9.0
Mean Hb conc.± SD; Median (range)	10.86±0.99;	10.90 (7.0 - 15.70)
Level of Hb conc. at 28 weeks		
Moderate anaemia (7.0 - 8.9g/dl)	4	1.0
Mild anaemia (9.0 - 10.9g/dl)	198	48.3
Not anaemic (≥11.0g/dl)	151	36.8
Lost to follow-up	57	13.9
Mean Hb conc.± SD; Median (range)	10.80±0.72;	10.80 (8.7 - 13.1)
Level of Hb conc. at 32 weeks		
Moderate anaemia (7.0 - 8.9g/dl)	0	0.0
Mild anaemia (9.0 - 10.9g/dl)	161	39.3
Not anaemic (≥11.0g/dl)	191	46.6
Lost to follow-up	58	14.1
Mean Hb conc.± SD; Median (range)	11.02±0.76;	11.0 (9.1 - 13.3)
Level of Hb conc. at 36 weeks		
Moderate anaemia (7.0 - 8.9g/dl)	0	0.0
Mild anaemia (9.0 - 10.9g/dl)	130	31.7
Not anaemic (≥11.0g/dl)	240	58.5
Lost to follow-up	40	9.8
Mean Hb conc.± SD; Median (range)	11.27±0.77;	11.20 (9.2 - 13.8)

SD - Standard deviation, Hb conc. - Haemoglobin concentration

Table 3 shows a comparison of the change in mean Hb concentration of the study population at the different assessment periods. A significant decrease in mean Hb concentration was observed between booking and 28 weeks (11.34±1.34 versus 10.80±0.72; p=0.0001), while a significant increase was observed between 24 and 36 weeks (10.82±0.98 versus 11.26±0.77; p=0.0001), between 28 and 36 weeks (10.78±0.70 versus 11.25±0.76; p=0.0001), and between 32 and 36 weeks (11.03±0.75 versus 11.28±0.78; p=0.0001).

Table 3: Comparison of mean Haemoglobin concentration to deduce the mean change at the different assessment periods for the study population (using paired t-test).

Variables		Hb concentration (g/dl)		t	p-value
		Mean ± SD	Mean change ± SD		
Pair 1	At booking	11.32±1.30	-0.45±1.12	-7.822	0.0001*
(N = 373)	At 24 weeks	10.86±0.99			
Pair 2	At booking	11.34±1.34	-0.54±1.23	-8.250	0.0001*
(N = 353)	At 28 weeks	10.80±0.72			
Pair 3	At booking	11.34±1.34	-0.32±1.31	-4.508	0.0001*
(N = 352)	At 32 weeks	11.02±0.76			
Pair 4	At booking	11.30±1.33	-0.03±1.20	-0.551	0.582
(N = 370)	At 36 weeks	11.27±0.77			
Pair 5	At 24 weeks	10.82±0.99	-0.04±0.99	-0.796	0.427
(N = 332)	At 28 weeks	10.78±0.72			
Pair 6	At 24 weeks	10.88±1.00	0.13±1.02	2.424	0.016*
(N = 337)	At 32 weeks	11.01±0.76			
Pair 7	At 24 weeks	10.82±0.98	0.43±0.96	8.500	0.0001*
(N = 351)	At 36 weeks	11.26±0.77			
Pair 8	At 28 weeks	10.80±0.73	0.18±0.71	4.709	0.0001*
(N = 327)	At 32 weeks	10.99±0.73			
Pair 9	At 28 weeks	10.78±0.70	0.47±0.68	12.615	0.0001*
(N = 338)	At 36 weeks	11.25±0.76			
Pair 10	At 32 weeks	11.03±0.75	0.25±0.65	7.087	0.0001*
(N = 340)	At 36 weeks	11.28±0.78			

*Statistically significant ($p<0.05$); SD - Standard deviation

Table 4 shows the mean Hb concentration changes of the anaemic and not-anaemic women at booking, at the different assessment periods. Women who were anaemic at booking showed a steady and significant increase in mean Hb throughout the period from 10.30±0.74 at 24 weeks to 10.93±0.68 at 36 weeks. Among the not-anaemic group at booking, apart from a slight dip at 28 weeks, there was also a significant increase from 11.16±0.97 at 24 weeks to 11.45±0.76 at 36 weeks. The differences in the mean Hb concentration between the anaemic and not-anaemic group at the different assessment periods were statistically significant (p=0.001 respectively).

Table 4: Assessment of the mean Haemoglobin concentration of women (at the different assessment periods) according to their Hb status at booking.

Hb status at booking				
Assessment periods	**Anaemic Mean Hb conc ± SD**	**Not anaemic Mean Hb conc ± SD**	**t**	**p-value**
At 24 weeks	10.30±0.74	11.16±0.97	-8.755	0.0001*
At 28 weeks	10.48±0.68	10.96±0.69	-6.272	0.0001*
At 32 weeks	10.78±0.67	11.15±0.77	-4.384	0.0001*
At 36 weeks	10.93±0.68	11.45±0.76	-6.549	0.0001*

*Statistically significant (*p<0.05*); SD - Standard deviation; Hb conc. - Haemoglobin concentration

Table 5 shows the proportion of the anaemic and not-anaemic women who remained or developed anaemia through the assessment period. Among the anaemic group at booking, there was a steady increase in the proportion that became not-anaemic from 15.4%, to 19.1%, to 31.6% and 44.1% at 24-, 28-, 32-, and 36- weeks respectively. Conversely, for those who were not-anaemic at booking, a good proportion developed anaemia subsequently, 30.7%, 40.1%, 31.0%, and 21.9% at 24-, 28-, 32-, and 36- weeks respectively. The differences in the proportions were all statistically significant (p=0.0001 respectively). The proportion of participants lost to follow up was higher in the not-anaemic group than for the anaemic group at the different assessment periods.

Table 5: Anaemia profile changes at the different assessment periods among the women according to their status at booking

Variables	**Hb status at booking**				
	Anaemic N = 136 n (%)	**Not anaemic N =274 n (%)**	**Total N = 410 n (%)**	**Chi square**	**p-value**
Level of Hb concentration at 24 weeks					
Anaemia (<11.0g/dl)	107 (78.7)	84 (30.7)	191 (46.6)	85.633	0.0001*
No anaemia (≥11.0g/dl)	21 (15.4)	161 (58.8)	182 (44.4)		
Lost to follow-up	8 (5.9)	29 (10.6)	37 (9.0)		
Level of Hb concentration at 28 weeks					
Anaemia (<11.0g/dl)	92 (67.6)	110 (40.1)	202 (49.3)	31.351	0.0001*
No anaemia (≥11.0g/dl)	26 (19.1)	125 (45.6)	151 (36.8)		
Lost to follow-up	18 (13.2)	39 (14.2)	57 (13.9)		
Level of Hb concentration at 32 weeks					
Anaemia(<11.0g/dl)	76 (55.9)	85 (31.0)	161 (39.3)	24.481	0.0001*
No anaemia (≥11.0g/dl)	43 (31.6)	148 (54.0)	191 (46.6)		
Lost to follow-up	17 (12.5)	41 (15.0)	58 (14.1)		
Level of Hb concentration at 36 weeks					
Anaemia (<11.0g/dl)	70 (51.5)	60 (21.9)	130 (31.7)	38.254	0.0001*
No anaemia (≥11.0g/dl)	60 (44.1)	180 (65.7)	240 (58.5)		
Lost to follow-up	6 (4.4)	34(12.4)	40 (9.8)		

*Statistically significant (*p*<0.05)

Discussion

Determining anaemia at booking among pregnant women affords one the opportunity to institute interventions to correct it and prevent the possible complications associated with anaemia in pregnancy. Doubts have been expressed regarding supplementation programmers and their effectiveness in reducing the prevalence of anaemia among pregnant women [10]. It has also been established that a combination of interventions may yield a stronger effect compared to one intervention [11]. Participants in this study received iron and folate supplementation, malaria chemoprophylaxis with intermittent preventive treatment, deworming with a single dose of anthelmintics, and health education on nutrition and other relevant topics. Direct observed therapy was used at each visit, to ensure compliance with malaria chemoprophylaxis, a method with proven effectiveness by previous studies [7, 12]. In developing any appropriate healthcare programme, it is necessary to assess to what extent the method can be expected to decrease anaemia among pregnant women.

This study revealed a booking anaemia prevalence of 33.2%, which compares favorably with findings from other southern Nigeria states of 32.2% from Benin city, [13] 35.3% from Lagos, [14] and 37.6% from Warri [15]. This is however, at variance to the findings from other centers with relatively higher prevalence of 54.5% from Uyo, [16] 62.2% from Ilesha, [17] and 58.0% from Ogbomosho [18]. Methodological differences, socio-cultural differences and geographical variations among regions may be responsible for the variance in reported prevalences of anaemia in pregnant women.

The proportion of initially anaemic women who had their anaemia corrected, increased significantly as the GA increased to 36 weeks. The maximum increase in Hb level was achieved among women with moderate anaemia, as moderate anaemia was abolished from the participants by 32 weeks. This compares fairly favorably with the findings of previous studies [13, 19]. It is evident from this study therefore, that quality antenatal care can modify maternal anaemia in pregnancy. Other studies have also alluded to a positive effect on Hb concentration with the right

application of antenatal care anaemia preventive measures [13, 15]. However, it was observed that by 28 weeks GA, a good proportion of the women were anaemic despite being recruited and participating in the study. This included previously anaemic and not-anaemic women who became anaemic. This reduction in Hb level can be attributed to the physiological anaemia that usually occurs in the second and early third trimesters due to the disproportionate increase of plasma volume with respect to the red cell mass and increased foetal demand for haemopoietic factors [16]. Besides, at this GA, the full benefits of the interventions were yet to manifest. Another possible explanation for persistent anaemia is non-adherence to the drugs given [20].

The proportion of defaulters in this study at each assessment period was higher for the not anaemic than the anaemic group. It has been observed in a previous study, that women who were anaemic at booking are more compliant to treatment and follow-up than not-anaemic women [10]. In this study, the same care was given to all the participants, but their individual perception of the seriousness of the problem, and hence compliance, must have had implications on the subsequent response to the interventions given. Furthermore, majority of the study participants, over 80%, registered in the second trimester. Such late booking reduces the relative treatment period of the interventions and, in addition for the primigravida, malaria will have already exerted its effects [21].

Conclusion

The prevalence of anaemia at booking was 33.2%. Anaemia preventive measures were effective in eliminating moderate anaemia and reversing a good proportion of women with mild anaemia at booking. Despite these measures some not-anaemic mothers developed anaemia subsequently. Generally, there was a positive correlation between haemoglobin concentration pattern in pregnancy and anaemia preventive measures.

It is evident that iron and folate supplementation, combined with malaria chemoprophylaxis, and nutritional health education, offers a good antenatal preventive intervention for anaemia in pregnancy. Involvement of the husbands in antenatal care can reduce women defaulting and help in ensuring compliance and adherence to interventions recommended.

Conflict of Interest

Not available.

Financial Support

Not available.

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