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Original Research Article

Impact of pharmacist-monitored patient education in pregnant women with anemia: a knowledge, attitude and practice study

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ABSTRACT

Background: Anemia during pregnancy, defined as hemoglobin levels below 11 g/dL, affects nearly 37% of pregnant women globally and 52.2% in India. Pharmacists are well positioned to provide education, though evidence for the impact of pharmacist-led interventions on knowledge, attitudes, and practices (KAP) regarding anemia is limited. This study evaluated the impact of pharmacist-monitored patient education on KAP in pregnant women with anemia.

Methods: This six-month prospective interventional study (Jan-2025 to June-2025) was conducted among 130 pregnant women at a tertiary care hospital in Mangaluru, Karnataka. Data were collected during routine antenatal visits using a validated structured questionnaire in English and Kannada. Following initial KAP assessment, participants received pharmacist-led counselling and educational informational leaflet. KAP was reassessed after 1.5 months using the same questionnaire. Data were analysed using SPSS, with one-way ANOVA and paired t-tests. A p value <0.05 was considered statistically significant.

Results: Most participants were aged 26-35 years (65.38%), rural residents (62.30%) with high school education (61.54%) and no prior anemia history (80%); most were unemployed (83.84%), multigravida (59.24%), in their third trimester (63.14%), and continued their usual diet (84.62%). Knowledge (1.92 ± 2.70 to 5.16 ± 3.61) and attitude (14.67 ± 2.53 to 15.91 ± 2.48) scores increased significantly ($p < 0.00001$, $p = 0.00096$), while practice scores changed minimally (2.72 ± 0.59 to 2.76 ± 0.58 ; $p = 0.08326$) post intervention. Knowledge was associated with education ($p = 0.0406$); attitude with age, residence, and parity ($p < 0.05$); and practice with age ($p = 0.0199$). Anemia Mukht Bharat awareness rose from 10% to 60%.

Conclusions: Pharmacist-monitored education significantly improved knowledge and attitude towards anemia in pregnancy, though practice change was limited. Integrating pharmacist-led counselling into antenatal care may support sustained behavioural change and anemia prevention.

Keywords: Anemia, Anemia Mukht Bharat, Antenatal care, Maternal education, Pregnancy

INTRODUCTION

The World Health Organization defines anemia in pregnancy as hemoglobin concentration below 11 g/dL, and it remains one of the most common nutritional disorders among pregnant women worldwide.¹ Globally, approximately 37% of pregnant women are affected.²

While national data place India's burden considerably higher, the fifth National Family Health Survey (NFHS-5, 2019-2021) found that over half (52.2%) of pregnant Indian women were anemic, with the highest risk centered among adolescent mothers, women with little or no formal education, and those from poorer households.³ This makes anemia in pregnancy a major public health issue in India, despite several national nutrition and anemia control

programs.⁴ The persistently high burden places considerable pressure on health care systems, particularly in ensuring effective prevention, early detection, and management during antenatal care.

Increased iron demand during pregnancy, combined with inadequate dietary intake and deficiencies of essential nutrients such as iron, folate, and vitamin B12, contributes significantly to the development of anemia among pregnant women.⁵ Poor dietary practices, including a low intake of meat, green leafy vegetables, and dairy products, may further increase this risk.⁶ Sociocultural factors such as early marriages, repeated pregnancies, and limited access to antenatal care also contribute to the increased prevalence rates of anemia in developing countries.³ Additionally, infections like malaria and parasitic infestations, including hookworm, along with underlying inflammatory conditions, can further contribute to anemia during pregnancy.⁷ Together, these factors highlight the multifactorial nature of anemia during pregnancy.

If left untreated, it can lead to serious maternal and fetal complications, including postpartum hemorrhage and an increased risk of maternal mortality.⁸ It can also result in intrauterine growth restriction, low birth weight, preterm labor, and increased perinatal mortality.⁹ Therefore, early identification of signs and symptoms, combined with routine antenatal screening, is important for the timely detection and prevention of these complications.

Once diagnosed, timely management can include nutritional interventions, iron and folic acid (IFA) supplementation, dietary counseling, food fortification, and, in severe cases, blood transfusion.¹⁰ Despite the availability of effective treatment strategies, there remain evident gaps in proper utilization of these measures by the target population. This highlights the need for coordinated public health interventions that can empower prevention, early detection, and sustained behaviour change.

To address these challenges, the Government of India launched the Anemia Mukht Bharat (AMB) initiative as a part of the National Nutrition Mission under the POSHAN (Prime Minister's Overarching Scheme for Holistic Nourishment) Abhiyaan. The strategy was originally implemented through a 6x6x6 framework, but it has recently been updated to a 7x7x7 approach involving seven beneficiary groups, seven interventions, and seven institutional mechanisms to strengthen anemia prevention and management efforts further.¹¹ The updated interventions include prophylactic IFA supplementation, anemia testing, therapeutic management, deworming and delayed cord clamping, Jan Bhagidari as a communication strategy, management of non-nutritional causes of anemia, and the "Eating Right" approach to promote locally available iron-rich foods and dietary diversification.¹² In spite of this national initiative, awareness and uptake among pregnant women remain comparatively low. This gap between national programme reporting and ground-level awareness is part of what motivated the present study.

Healthcare professionals, particularly pharmacists, are well positioned to address these behavioral and informational gaps related to anemia prevention and management. As pharmacists are among the most accessible healthcare professionals in both urban and rural areas, they frequently interact with pregnant women during medication dispensing and antenatal care, providing valuable opportunities for patient education and counselling by promoting awareness, improving dietary habits, and enhancing compliance with supplementation.¹³ However, in the specific context of anemia during pregnancy, most Indian studies assessing knowledge, attitude, and practice (KAP) have been conducted by obstetric or nursing teams rather than pharmacists. Consequently, evidence on pharmacist-led KAP interventions among pregnant women remains limited, particularly in coastal Karnataka, where local dietary practices, literacy levels, and healthcare-seeking behaviors may differ from those reported in other settings. This gap provided the rationale for the present study.

This study aims to evaluate the knowledge, attitude, and practice (KAP) about anemia and its management among pregnant women, while assessing their knowledge and practices related to anemia prevention. This study also examines the relationship between educational status and anemia related awareness to identify factors that may influence preventive behaviours and anemia management.¹⁴ Through pharmacist-led counselling and provision of structured patient information leaflets, this study aims to improve maternal awareness of anemia, increase adherence to iron-folic acid supplementation, and create awareness of the Anemia Mukht Bharat scheme, ultimately contributing to evidence on how pharmacist involvement in routine antenatal care can support India's anemia reduction efforts.^{11,15}

METHODS

A prospective interventional study was conducted for six months, from January 2025 to June 2025, at a tertiary care hospital in Mangaluru, Karnataka, to evaluate whether pharmacist-led patient education on Knowledge, Attitude, and Practice (KAP) regarding anemia in pregnant women was effective. Approval from the Institutional Ethics Committee (SIEC/SIMSRC/PG01/02/2025) was received for this study.

The study involved 130 pregnant women who were aged 18 or above, attending antenatal care, had a haemoglobin level below 11g/dL, and were willing to give informed consent. Women with high-risk pregnancies, severe conditions that affect haemoglobin levels, or who had received a blood transfusion within the past three months before participation were not included in the study.

Information was collected using a structured questionnaire in both English and Kannada. The questionnaire assessed knowledge regarding awareness, causes, symptoms, treatment, complications, dietary management, and the

Anemia Mukht Bharat initiative related to anemia during pregnancy. Attitude was assessed regarding the importance of regular antenatal care and blood investigations, adherence to a healthy or special diet, and the association between closely spaced pregnancies and anemia. Practice was assessed based on adherence to iron and other supplement use, reasons for irregular supplement consumption, frequency of antenatal care visits, utilization of antenatal care services, and use of free supplements provided by government healthcare facilities. Knowledge and practice were assessed using scoring methods, while attitude was measured using a five-point Likert scale. The questionnaire was validated by experts, including gynaecologists, academic faculty members, and clinical pharmacists, to ensure content validity and the clarity of the questions.

The intervention involved pharmacist-led counselling sessions for the participants. A patient information leaflet (PIL) on anemia was developed by the authors based on information obtained from the Anemia Mukht Bharat (AMB) Operational Guidelines of the Ministry of Health and Family Welfare, Government of India, and was provided to the participants as part of the patient education intervention.¹¹ The leaflet included information on anemia, dietary modification, the importance of iron- folic acid supplements, prevention methods, and awareness about the Anemia Mukht Bharat initiative. The KAP scores were assessed before the intervention and reassessed 1.5 months after the pharmacist-led counselling session using the same structured questionnaire to determine the impact of the educational intervention and evaluate changes in participants' knowledge, attitude, and practices.

For statistical analysis, Microsoft Excel and the Statistical Package for Social Sciences (SPSS) were used. The relationship between demographic factors and KAP scores was checked using one-way ANOVA. The comparison between pre-intervention and post- intervention scores was done by using a paired t-test. A p value <0.05 was considered statistically significant.

RESULTS

Socio-demographic characteristics of the study participants

A total of 130 pregnant women were included in the study. Majority of participants were between 26-35 years of age (85, 65.38%). A normal body mass index (BMI 18.5-24.9 kg/m²) was observed in 57 (43.84%) participants. High school education was the most common educational qualification (80, 61.54%). Unemployment was predominant among the study participants (109, 83.84%), while a monthly family income of ₹10,000-₹20,000 was reported by 70 (53.85%). Rural residence was more common than urban residence, with 81 (62.3%) participants residing in rural areas. In terms of parity, nulliparous and primiparous women were equally represented, each comprising 50 (38.46%) participants.

The third trimester was the predominant stage of pregnancy (82, 63.14%). The majority of participants had no previous history of anemia (104, 80.00%), and did not experience bleeding during pregnancy (122, 93.85%). Multigravida women constituted a larger proportion of the study (77, 59.24%), and 110 (84.62%) of the participants reported that they consumed their usual diet during pregnancy (Table 1).

Table 1: Sociodemographic characteristics of the participants.

Variables	Category	Number	Percent
Age group (in years)	18-25	39	30.00
	26-35	85	65.38
	36-45	6	4.62
BMI (in kg/m²)	Underweight (below 18.5)	5	3.84
	Healthy weight (18.5-24.9)	57	43.84
	Overweight (25-29.9)	38	29.24
	Obese (30 or higher)	30	23.08
Education	Illiterate	6	4.62
	High school	80	61.54
	Masters	44	33.84
Occupation	Employed	21	16.16
	Unemployed	109	83.84
Income (in ₹)/months	>20,000	29	22.30
	10,000-20,000	70	53.85
	<10,000	31	23.85
Residence	Rural	81	62.30
	Urban	49	37.70
Parity	Nulliparity	50	38.46
	Primiparity	50	38.46
	Multiparity	30	23.08
Trimester in months	First (1-3)	14	10.73
	Second (4-6)	34	26.13
	Third (7-9)	82	63.14
History of anemia	Yes	26	20.00
	No	104	80.00
Bleeding during pregnancy	Yes	8	6.15
	No	122	93.85
Gravida	Primigravida	53	40.76
	Multigravida	77	59.24
Type of diet	Usual	110	84.62
	Special	20	15.38

All 130 participants received the patient information leaflet and pharmacist-led counselling regarding anemia during pregnancy. The participants' knowledge, attitude, and practices were reassessed 1.5 months after the intervention using the same structured questionnaire administered at baseline.

Baseline knowledge regarding anemia

The baseline assessment showed that participants had limited knowledge regarding anemia during pregnancy. Only 48 (36.93%) of the participants were aware about anemia in pregnancy. Among these participants, multiple sources of information were reported. Healthcare professionals turned out to be the primary source of information (31 responses, 23.85%), followed by family members or friends (8 responses, 6.16%), books or pamphlets (2 responses, 1.53%) and media (2 responses, 1.53%). Additionally, 3 (2.31%) participants reported receiving information from all of the above sources. Similarly, awareness on possible treatment options was also poor, since 93 (71.54%) participants reported that they did not know how anemia could be treated. Iron supplementation was identified as a treatment by only 24 (18.48%) of the participants. Awareness of the complications associated with anemia was particularly low. Only 13 (10%) reported that they were aware of the possible complications, and among those, low birth weight was the most frequently recognized consequence (5, 38.47%), followed by stillbirth (4, 30.77%), pre-term birth (1, 7.69%), maternal mortality (1, 7.69%), and all of these complications were recognized by only 2 (15.38%)

participants. Knowledge regarding dietary measures to prevent or manage anemia was also insufficient. Only 25 (19.24%) participants reported being aware of foods that can help prevent or manage anemia during pregnancy. Among these participants, the majority (18, 72.00%) correctly identified all of the listed food items like dates/dry fruits, chicken/mutton, green leafy vegetables, eggs or milk. The remaining participants identified only individual food items among the given options, with each response being reported by only one or two participants. Only 38 (29.40%) participants reported being aware of the symptoms of anemia. Among these participants, the majority (20, 52.62%) correctly identified all of the listed symptoms like tiredness, weakness, pallor of the eyes, or fatigue. The remaining participants identified only individual symptoms, with each response being reported by only a few participants. Awareness about Anemia Mukh Bharat programme was extremely limited, with only 13 (10%) participants reporting that they had heard about this national public health initiative. However, there was a substantial increase in the level of knowledge among the participants after providing patient information leaflet and adequate counselling, as indicated in Table 2.

Table 2: Assessment of participants' knowledge regarding anemia during pregnancy.

	Responses	Pre intervention		Post intervention	
		Number	Percent	Number	Percent
Have you heard about anemia in pregnancy?	Yes	48	36.93	90	69.30
	No	82	63.07	40	30.70
Do you know what causes anemia in pregnancy?	Poor diet	7	5.39	6	4.62
	Early pregnancy	1	0.76	1	0.76
	Blood loss	7	5.39	5	3.85
	Infection	2	1.53	2	1.54
	All of the above	16	12.31	71	54.61
	Don't know	97	74.62	45	34.61
What do you think is the treatment for anemia during pregnancy?	Iron supplements	24	18.48	23	17.69
	Blood transfusion	3	2.30	2	1.53
	Sleep	3	2.30	2	1.53
	All of the above	7	5.38	56	43.08
	Don't know	93	71.54	47	36.17
Do you know the risks/complications of anemia during pregnancy?	Yes	13	10.00	80	61.53
	No	117	90.00	50	38.46
Are you aware of the foods that can supplement or tackle anemia during pregnancy?	Yes	25	19.24	79	60.76
	No	58	44.61	29	22.30
	Not sure	47	36.15	22	16.92
Do you know the symptoms of anemia?	Yes	38	29.40	86	66.15
	No	92	70.60	44	33.85
Are you aware of the Anemia Mukh Bharat scheme?	Yes	13	10.00	78	60.00
	No	117	90.00	52	40.00

Attitudes regarding anemia prevention and management

Initially, attitudes toward anemia prevention and management were generally favourable even though major

misconceptions and uncertainties prevailed among the participants. The essentiality of regular antenatal care (ANC) visits and blood investigations during pregnancy were agreed by 80 (61.54%) and strongly agreed by 41

(31.50%) participants. Post-intervention, positive attitudes increased, with 88 (67.69%) of them agreeing. When asked about attitude towards consumption of additional supplements despite following a healthy diet, 73 (56.16%) agreed and 19 (14.61%) strongly agreed at baseline. Post-intervention, these proportions increased to 87 (66.90%) and 24 (18.40%), respectively, indicating more participants became aware of the necessity of supplementation during pregnancy. Also, prior to intervention, only 48 (36.94%) participants agreed and 11 (8.46%) strongly agreed that repeated pregnancies with short inter-pregnancy intervals contribute to anemia. Post-

intervention, agreement increased among 76 (58.50%) and strong agreement increased among 24 (18.4%) participants, demonstrating enhanced understanding that repeated pregnancies with less time gap can be major risk factor for anemia. Attitudes toward following a special diet during pregnancy also improved after the educational intervention. Before counselling, 60 (46.15%) agreed and 19 (14.61%) strongly agreed that a special diet was necessary during pregnancy, which increased to 81 (62.40%) and 28 (21.5%) participants after intervention respectively. Comparison of attitudes before and after providing counselling is depicted in Table 3.

Table 3: Assessment of participants' attitudes toward anemia during pregnancy.

	Responses	Pre intervention		Post intervention	
		Number	Percent	Number	Percent
Regular ANC and blood tests are essential during pregnancy	Strongly disagree	1	0.80	0	0.00
	Disagree	0	0.00	0	0.00
	Neutral	8	6.16	8	6.15
	Agree	80	61.54	88	67.69
	Strongly agree	41	31.50	34	26.16
Pregnant women should consume additional supplements in spite of a healthy diet	Strongly disagree	7	5.39	2	1.60
	Disagree	11	8.46	3	2.40
	Neutral	20	15.38	14	10.70
	Agree	73	56.16	87	66.90
	Strongly agree	19	14.61	24	18.40
It is essential to take a special diet during pregnancy	Strongly disagree	5	3.85	2	1.60
	Disagree	20	15.39	5	3.80
	Neutral	26	20.00	14	10.70
	Agree	60	46.15	81	62.40
	Strongly agree	19	14.61	28	21.50
Repeated pregnancy with less gap is a major cause of anemia	Strongly disagree	1	0.77	0	0.00
	Disagree	17	13.07	3	2.40
	Neutral	53	40.76	27	20.70
	Agree	48	36.94	76	58.50
	Strongly agree	11	8.46	24	18.40

Practice patterns related to anemia prevention

Assessment of maternal practices indicated poor adherence to recommended preventive measures. Irregular supplement consumption was reported by 99 (76.16%) participants before intervention, with forgetfulness (50, 50.50%) as the most common reason for their non-adherence, followed by the perception that supplementation was unnecessary (35, 35.35%). Although the intervention resulted in only modest improvements (Table 4), the proportion of women reporting irregular supplement use declined from 76.16% (99) to 70.80% (92). Awareness and utilization of free government-provided supplements improved after the intervention. The proportion of participants who reported using these supplements increased from 64 (49.24%) before the intervention to 76 (58.50%) afterward. In terms of ANC

attendance, the largest proportion of women attended seven to nine ANC visits (50, 38.47%), while 30.00% (39) reported attending four to six visits. Overall, ANC attendance patterns showed little changes following the intervention. The utilization of ANC-related services was generally high for complete blood count testing (128, 98.46%), ultrasonography (125, 96.15%) and TT vaccination (110, 84.61%). However, uptake of anthelmintic therapy (21, 16.15%), blood glucose testing (60, 46.15%), and thyroid function testing (69, 53.07%) remained comparatively low. Following the intervention, slight improvements were observed across several services. Complete blood count testing and ultrasonography both reached 100% utilization, while blood glucose testing, increased to 53.07% (69%), thyroid function testing to 54.61% (71), and anthelmintic therapy to 18.46% (24).

Table 4: Assessment of participants' practices related to anemia prevention and management during pregnancy.

	Responses	Pre-intervention		Post-intervention	
		Number	Percent	Number	Percent
Is your supplement consumption irregular?	Yes	99	76.16	92	70.80
	No	31	23.84	38	29.20
How often do you visit ANC's?	1-3 visits	34	26.16	30	23.08
	4-6 visits	39	30.00	41	31.54
	7-9 visits	50	38.47	51	39.23
	10-12 visits	7	5.37	8	6.15
Have you utilized free supplements from government hospitals?	Yes	64	49.24	76	58.50
	No	66	50.76	54	41.50

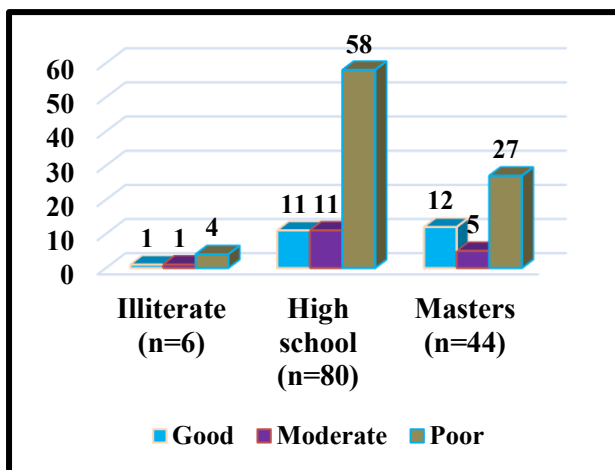
Awareness regarding Anemia Mukh Bharat

Participants showed poor awareness regarding the Government of India's Anemia Mukh Bharat (AMB) programme at baseline; only 13 participants (10%) knew about this programme, whereas 117 participants (90%) had never heard about it. But after intervention, total of 78 participants (60%) reported awareness of the AMB programme, representing a six-fold increase in awareness.

Association between sociodemographic factors and KAP domains

Educational status and knowledge

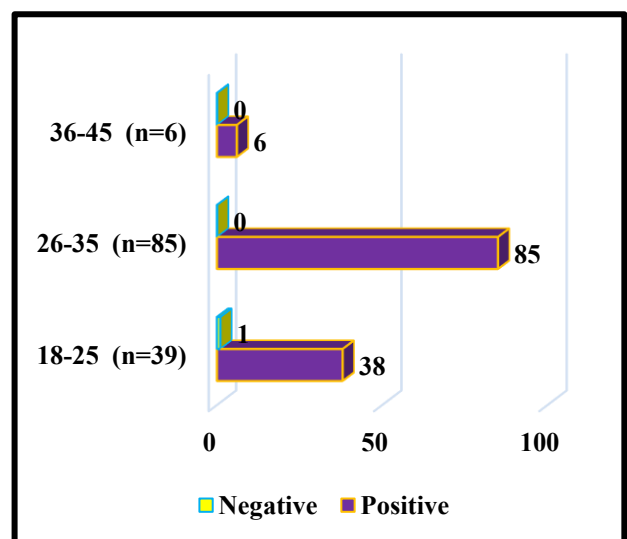
A statistically significant association was observed between educational status and knowledge regarding anemia ($F=3.287$, $p=0.0406$). Women with higher education generally demonstrated better knowledge scores compared with less educated participants (Figure 1).

**Figure 1: Association between education level and knowledge regarding anemia during pregnancy.**

Age and attitude

Age was significantly associated with attitudes regarding anemia prevention ($F=4.546$, $p=0.0124$). Participants aged

26-35 years demonstrated more positive attitudes compared with younger and older age groups (Figure 2).

**Figure 2: Association between age and attitude regarding anemia during pregnancy.**

Residence and attitude

Residence was significantly associated with attitude levels ($F=8.887$, $p=0.0034$). Urban participants were more likely to demonstrate positive attitudes toward anemia prevention compared with rural participants.

Parity and attitude

Parity was significantly associated with attitudes regarding anemia ($F=3.390$, $p=0.0386$). Nulliparous and primiparous women generally demonstrated more favourable attitudes compared with multiparous women.

Age and practice

Age was also significantly associated with practice scores ($F=4.042$, $p=0.0199$). Women aged 26-35 years exhibited better preventive practices than participants in other age groups (Figure 3).

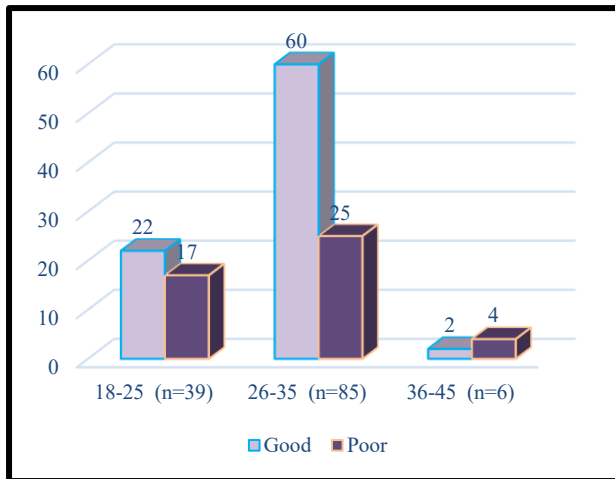


Figure 3: Association between age and practices regarding anemia during pregnancy.

Table 5: Comparison of pre- and post-intervention KAP scores using paired t-test (n=130).

Domain	Pre-intervention (Mean±SD)	Post-intervention (Mean±SD)	t value	P value
Knowledge	1.92±2.70	5.16±3.61	9.148069	<0.00001**
Attitude	14.67±2.53	15.91±2.48	3.380589	0.00096*
Practice	2.72±0.59	2.76±0.58	1.745636	0.08326

**highly statistically significant; *statistically significant

DISCUSSION

The present prospective interventional study was designed to assess the knowledge, attitudes, and practices (KAP) of pregnant women with anemia regarding anemia and to evaluate the impact of a pharmacist-monitored educational intervention during the antenatal care visits. The findings show important evidence of maternal knowledge regarding anemia, its causes, complications, treatment, and preventive measures. There was significant improvement in knowledge and attitudes after the intervention, while there was a marginal and statistically insignificant improvement in practices.

Regarding knowledge, 36.93% of women had heard of anemia in pregnancy, while 63.07% had not heard of it. Of those who had heard, 23.85% said that health professionals were the main source of information. These findings underscore the important role of health workers as the first source of information on maternal health.

About attitudes, many women had poor knowledge of the severity and preventability of anemia. Some of the respondents disagreed or were not sure that anemia is dangerous, or that anemia can be prevented by appropriate dietary practices and iron-folic acid supplementation.

In terms of practices, only a small percentage of women reported regular intake of iron and folic acid tablets, dietary modification, and regular antenatal check-ups. Many participants reported irregular adherence or no

Comparison of pre- and post-intervention KAP scores

The educational intervention resulted in significant improvements in knowledge and attitude scores, while short-term behavioural practices remained largely unchanged (Table 5).

Mean knowledge scores increased from 1.92 ± 2.70 before intervention to 5.16 ± 3.61 after intervention. This improvement was highly statistically significant ($t=9.148$, $p<0.00001$).

Mean attitude scores increased from 14.67 ± 2.53 to 15.91 ± 2.48 following intervention. The observed increase was statistically significant ($t=3.381$, $p=0.00096$).

In contrast, practice scores showed only a slight increase from 2.72 ± 0.59 to 2.76 ± 0.58 . This change did not achieve statistical significance ($t=1.746$, $p=0.08326$).

dietary changes. These findings are in line with the findings of Godara et al, and Patel et al who observed poor adherence to dietary and supplementation compliance.^{9,13}

Overall, compliance with iron-folic acid supplementation was poor, which is in line with the findings of Godara et al, Titaley et al, Nasir et al, and Habib et al who reported low adherence among pregnant women.^{13,16-18} Poor compliance can have an impact on the success of public health programs for the prevention of anemia.

Overall, the intervention resulted in a significant increase in the level of maternal knowledge. Association analysis showed several statistically significant associations. The association between education and knowledge was found to be significant ($p=0.040556$), which means the higher the level of education, better the understanding of anemia. This was also backed by the research work of Nivedita et al., Ghimire et al., and Nimbalkar et al.^{14,15,19} Age and attitude were significantly correlated ($p=0.019867$), where women between 26 and 35 years old showed good behaviours and positive attitudes. This could be related to repeated exposure to prenatal care and higher maturity. Attitudes were significantly associated with place of residence ($p=0.003444$), where women living in urban areas had more positive attitudes than women living in rural areas; similar findings were observed by Begum et al.²⁰ Attitude was significantly associated with parity ($p=0.0385996$), with more positive attitudes observed among nulliparous and primiparous women, possibly reflecting more caution in first pregnancies.

Comparison of KAP scores before and after intervention clearly indicates the effectiveness of pharmacist-monitored education. There was a significant increase in knowledge scores from 1.92 ± 2.70 before intervention to 5.16 ± 3.61 after intervention ($p < 0.00001$). This shows the effectiveness of the educational intervention in filling the knowledge gaps seen earlier. This is consistent with other studies showing that structured educational interventions improve maternal knowledge.^{15,21}

In addition, there was a statistically significant increase in the attitude scores from 14.67 ± 2.53 to 15.91 ± 2.48 ($p = 0.00096$). This suggests that standardized education may positively influence women's attitudes and beliefs regarding anemia prevention and management. Similar effects of health counseling on maternal beliefs have been reported by Ahmed et al.²²

In contrast, practice scores did not change (2.72 ± 0.59 pre- vs. post-intervention, $p = 1$). This finding highlights the persistent difficulty of translating improvements in knowledge and attitudes into sustained behavioral changes. Although educational interventions can improve awareness and attitudes, changes in actual practices may require longer follow-up, repeated counseling, family support, and improved access to healthcare services and supplements.

In conclusion, these findings support the effectiveness of educational interventions to improve knowledge and attitudes, but long-term follow-up, repetition, family support, and structural measures such as continuous supply of supplements and culturally appropriate counselling are needed for sustained positive practice change.

The intervention in this study to provide patient information leaflets and create awareness on Anemia Mukht Bharat showed potential to improve maternal knowledge and attitudes and may contribute to improved practices with continued strengthening. Similar findings were reported by Nimbalkar et al, Ahmed et al, Nahrisah et al, Sunuwar et al, Jalambo et al, Gomes et al, and Noronha et al.^{15,21-25} Collectively, these studies suggest that structured educational interventions can positively influence maternal knowledge, dietary practices, and supplementation compliance. Some studies have also reported improvements in hemoglobin levels.

The Anemia Mukht Bharat scheme provides an effective policy framework for reducing the burden of anemia in India. However, Totade et al, drawing on NFHS-5 data, found that its effectiveness is still limited by deployment gaps (Geographic Insights Lab 2022).²⁶ The results of the present study are consistent with the opinion that despite the existence of the policy system, a significant reduction in the prevalence of anemia needs ongoing awareness campaigns, community-based education, and training of health professionals.

This study has important implications for public health. Structured educational interventions, greater involvement of healthcare professionals in counselling, and culturally sensitive strategies should reinforce control programs against anemia. Particular attention should be directed to vulnerable populations such as rural populations, less educated women, and younger age groups.

The present study shows inadequate knowledge, attitude, and poor compliance among anemic pregnant women. The major factors were poor knowledge, attitude, and compliance. Knowledge, attitudes, and practice were associated with demographic factors like age, education, residence, and parity, thus highlighting their importance in maternal health, improving maternal awareness and reducing the burden of anemia in pregnancy.

CONCLUSION

This study demonstrated that pharmacist-led education was effective in enhancing pregnant women's awareness of anemia. Following the intervention, participants were better able to recognize the causes of the condition and its complications, the need for an iron-rich diet, iron-folic acid supplements, and the Anemia Mukht Bharat initiative. Despite the success of the interventions and the improvement in knowledge, the changes in behaviour have been less impressive. Thus, it indicates that to manage changes in health behaviour properly, continuous support, training, and family involvement are required; pharmacist-led education also needs to be integrated into the provision of antenatal care. The research emphasizes that pharmacists can be of great help in the provision of prenatal care by means of performing health education, health promotion, and providing medication counselling.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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