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Knowledge, Attitude, and Practices towards Nutritional Anaemia among Farm Women in Different Districts of the Seemanchal Region of Bihar

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Abstract

Anaemia is a major public health concern that mostly affects women. Nutritional Anaemia refers to any medical disease where a deficiency in one or more nutrients causes the blood haemoglobin concentration to fall to an abnormally low level. This study investigates the knowledge, attitudes, and practices [KAP] of anaemic farm women towards disorder management. A cross-sectional study was conducted among 240 farm women selected from highly anaemia-affected blocks of the four Seemanchal districts of Bihar. Data were collected between April and December 2025 using a validated semi-structured interview schedule. The collected data were analysed using descriptive statistics and Pearson's correlation coefficient to assess the knowledge, attitude, and practices [KAP] related to nutritional anaemia. The study revealed that respondents possessed moderate knowledge, favourable attitudes, and moderate practices regarding nutritional anaemia. Education, mass media exposure, social participation, extension contact, and dietary diversity were found significantly influencing their KAP levels. The findings emphasize the need for strengthened nutrition education, digital awareness initiatives, and extension interventions to bridge the knowledge–attitude- practice [KAP] gap and improve anaemia management among farm women.

Introduction

Anaemia is a serious public health issue that primarily affects young children, pregnant and postpartum women, and teenage girls and women who are menstruating. A deficiency in the amount or quality of red blood cells or haemoglobin in the blood is known as anaemia [1]. As a result, people with anaemia may have lower productivity [2], diminished physical performance [3], and heightened vulnerability to falls or mishaps [4]. Additionally, many studies revealed that anaemia may be a risk factor for serious consequences such as heart conditions, child developmental delays, and neurological development. The phrase "nutritional anaemia" refers to any medical disease where a deficiency in one or more nutrients causes the blood haemoglobin concentration to fall to an abnormally low level [5]. Iron, folic acid, and vitamin B12 are the primary nutrients required for the production of haemoglobin. In terms of public health, the most common cause of nutritional anaemia globally is iron deficiency [6]. Iron deficiency and folic acid deficiency are fewer common conditions. Deficiency of vitamin B12 is far less common [7].

Globally, anaemia prevalence is a significant concern, particularly harming underdeveloped countries. Low- and lower-middle income countries bear the greatest burden of anaemia, particularly affecting populations living in rural settings, in poorer households and who have received no formal education [8]. Globally, it is estimated that 40% of all children aged 6–59 months, 37% of pregnant women and 30% of women 15–49 years of age are affected by anaemia [9]. Anaemia caused 50 million years of healthy life lost due to disability in 2019. The largest causes were dietary iron deficiency, thalassaemia and sickle cell trait, and malaria [10]. This prevalence varied widely across different regions and populations, with higher rates observed in low- and middle-income countries, particularly in South Asia, Central and West Africa, and parts of Southeast Asia. In India, the prevalence varies widely across different regions and populations. According to National Health Survey-5 [2019–2021), the prevalence of anaemia in India is

most common among children aged 6–59 months (67.1%) and adolescent girls (59.1%), while women (57%) and pregnant women (52.2%) also have high rates compared to men (25%) [11]. In India, the states including Bihar and Odisha have high rates of anaemia among women and children [Anaemia in India, 2026]. According to reports, over 64% of girls in the Bihar region have anaemia, which is significantly higher than the national average of 57% [12]. In Seemanchal area of Bihar, the prevalence of anaemia was reported high than rest of Bihar which is mainly because of farm women widespread poverty, poor dietary diversity, high illiteracy, and recurrent parasitic infections [13]. These figures highlight the significant public health challenge posed by anaemia in Bihar. Despite the implementation of several control measures and nutrition-focused programs by the Central and State Governments, the prevalence of anaemia among women and teenage girls in Bihar remains shockingly high [14]. Significant government initiatives, such as Anaemia Mukt Bharat, the Mid-Day Meal Scheme, Mission Saksham Anganwadi and Poshan 2.0, and other health and nutrition interventions, have been put in place to improve nutritional status and reduce iron deficiency among disadvantaged groups [15].

The successful control of anaemia requires not only appropriate medical treatment but also active engagement of patients in managing their own health and well-being. This involves gaining adequate knowledge about the condition [16], following prescribed treatment regimens [17], and adopting appropriate lifestyle modifications [18]. A Knowledge, Attitudes, and Practices (KAP) study is a widely used research method that assesses the level of understanding, attitudes, and practices of a population concerning a specific health-related topic [19]. In the context of anaemia management, a KAP study seeks to assess farm womens' knowledge of anaemia, their perceptions and attitudes toward the condition, and the practices they adopt for its management. To date, there is limited evidence from KAP studies among Seemanchal Bihar patients with anaemia, which has hindered efforts to enhance the prevention, treatment, and management of the condition.

To address these research gaps, the present study aimed to assess the knowledge, attitudes, and practices (KAP) of farm women with anaemia regarding disease management. By identifying the factors that influence KAP, the study provides valuable insights for designing patient-centred interventions. We hypothesized that positive associations exist among the three KAP domains. The findings may support the development of evidence-based strategies to improve the quality of care and support for individuals living with anaemia.

Methods

The present study is cross-sectional study which forms part of a project conducted with farm women "Development of mobile based application for nutritional anaemia awareness among farm women in Seemanchal region of Bihar". The study was conducted in four seemanchal districts of Bihar viz. Kishanganj, Katihar, Purnia and Araria as these districts are severely affected by nutritional anaemia [14]. Out of these four districts the two blocks which were highly affected by nutritional anaemia were purposively selected. From each block 30–30 farm women were selected randomly. Hence the total sample size was 240 which were drawn through multistage random sampling. The semi structured

interview schedule was prepared based on the secondary studies. Self-administered questionnaire were used in the study, and it was based on and modified from previous research [20, 21, 22, and 23]. The content validation of the questionnaires was done by cross reference and verification from the experts in the identified field. Reliability of the questionnaires had also been tested among the non-sample population having similar socio-economic background and finalized. The schedule was developed for the study in Hindi. The knowledge items were scored 1 point for a correct answer and 0 points for others, resulting in a possible score range of 0–10. The attitude items scored on a five-point Likert scale ranging from very positive (5 points) to very negative (1 point), with a possible score range of 8 to 40. The practice items also scored on a five-point Likert scale, ranging from very consistent (5 points) to very inconsistent (1 point), with a possible score range of 05 to 25. The respondents' socio-demographic characteristics, such as age, educational level, work duration, farming experience and extension contact, etc were collected during the study. Data was collected during the April to December; 2025. The statistical methods administered were mean, per cent, Standard Deviation, Rank and correlation coefficient. Pearson correlation analysis was used to analyse the correlation between KAP. For analysis of data IBM SPSS 21 was employed.

Result

Assessing the socio-economic characteristics of farm women is crucial for understanding their knowledge, attitude and practices abilities regarding nutritional issues. Accordingly, the study examined the socio-economic profile of the respondents by collecting and analysing information on age, educational status, family size, occupation, annual income, landholding, and social participation.

Table 1
Socio-economic Profile of Farm Women

Variables	Mean	SD	Frequency [Percentage]
Age (In years)	26.31	6.08	-
Education (In years)	6.50	4.04	-
Family Type			
Nuclear (0)	-	-	117 (48.75)
Joint (1)			123 (51.25)
Family Size	5.34	1.96	-
Farming Experience (In years)	9.82	5.23	-
Time Spend in Field (In hrs.)	5.67	1.88	-
Land ownership			
Owned	-		170 (70.83)
Leased in			70 (29.17)
Total livestock	9.02	5.64	-
Cattle	-		99 (41.25)
Goat			155 (64.58)
Poultry			207 (86.25)
Social Participation	2.00	1.30	-
Mass Media Exposure (Measures in 3-point quantum)	8.20	4.21	-
Newspaper	-	-	110 (45.83)
TV			128 (53.33)
Mobile/social media			165 (68.75)
Farm Publication			91 (37.92)
Awareness Campaign			101 (42.08)
Others			76 (31.67)
Extension Participation (Measures in 3-point quantum)	5.54	3.35	-
Demonstration	-		207 (86.25)
Training			217 (90.42)
(n = 240)			

Variables	Mean	SD	Frequency [Percentage]
Group Meeting			214 (89.17)
Others			180 (75.00)
(n = 240)			

The socio-economic characteristics of the farm women indicated that the respondents were predominantly young, with an average age of 26.31 ± 6.08 years. The mean educational attainment was 6.50 ± 4.04 years of schooling. The family composition analysis revealed that 51.25 per cent of the respondents belonged to joint families, while 48.75 per cent lived in nuclear families, with an average household size of 5.34 ± 1.96 members. The respondents possessed considerable farming experience, averaging 9.82 ± 5.23 years, and spent approximately 5.67 ± 1.88 hours per day on farming activities. A majority (70.83%) belonged to households owning agricultural land, whereas 29.17 per cent were landless. Livestock husbandry constituted a significant livelihood component, with an average livestock holding of 9.02 ± 5.64 animals per household. Poultry rearing was the most common enterprise (86.25%), followed by goat rearing (64.58%) and cattle rearing (41.25%). The findings further showed a moderate level of social participation among the respondents, with a mean score of 2.00 ± 1.30, suggesting involvement in community and social organizations. Mass media exposure was relatively high (8.20 ± 4.21), with mobile phones and social media serving as the most frequently utilized information sources (68.75%), followed by television (53.33%), newspapers (45.83%), awareness campaigns (42.08%), farm publications (37.92%), and other communication channels (31.67%). Extension participation was also found to be substantial, with a mean score of 5.54 ± 3.35. Most respondents reported attending training programmes (90.42%), followed by group meetings (89.17%), demonstrations (86.25%), and other extension activities (75.00%).

Table 2
Knowledge of the Respondents towards Nutritional Anaemia

Statement	***F* (%)**
Anaemia refers to a reduction in haemoglobin levels in the blood of the human body.	159 (66.25)
Imbalanced diet, poor cooking habits diseases can lead to insufficient intake of iron, folic acid, and vitamin B12, causing nutritional anaemia.	155 (64.58)
The skin of individuals with nutritional anaemia generally appears pale.	150 (62.50)
Nutritional anaemic farm women may experience symptoms such as headaches, tinnitus, and cerebral hypoxia.	155 (64.58)
The main causes of occurrence of nutritional anaemia are due to heavy blood loss, ongoing chronic diseases, mutation and poor nutrition.	144 (60.00)
Iron deficiency nutritional anaemia occurs due to the low iron count in women body.	155 (64.58)
Family history, diabetes, HIV leads to Vit B12 deficiency anaemia.	156 (65.00)
Although the causes of anaemia may vary, the treatment principles are the same.	150 (62.50)
Treatment options for nutritional anaemia may include consumption of iron supplements, healthy and balanced diet.	147 (61.25)
Establishing Nutri-farm and consuming its products can prevent nutritional anaemia	150 (62.50)
Total knowledge of the respondents	6.34 (2.20)
Low (up to 33.33)	52 (21.67)
Medium (33.34–66.66)	100 (41.67)
High (more than 66.66)	88 (36.67)

The data presented in the Table 2 indicate that the respondents possessed a moderate level of knowledge regarding nutritional anaemia, with an overall mean knowledge score of 6.34 ± 2.20. The majority of the respondents (41.67%) fell under the medium knowledge category, followed by 36.67 per cent in the high knowledge category and 21.67 per cent in the low knowledge category.

Among the individual statements, the highest level of knowledge was observed regarding the statement that anaemia refers to a reduction in haemoglobin levels in the blood, as reported by 66.25 per cent of the respondents. Similarly, 65.00 per cent of the respondents correctly identified that family history,

diabetes, and HIV may contribute to Vitamin B12 deficiency anaemia. Knowledge regarding the role of poor dietary habits and nutrient deficiencies in causing nutritional anaemia, the symptoms of anaemia, and iron deficiency anaemia was reported by 64.58 per cent of the respondents. More than sixty per cent of the respondents were knowing that nutritional anaemia may cause symptoms such as headaches, tinnitus, and cerebral hypoxia, and that treatment may involve iron supplementation along with a healthy and balanced diet. Likewise, 62.50 per cent of the respondents recognized the pale appearance of the skin as a common symptom of nutritional anaemia and agreed that establishing a Nutri-farm and consuming its products could help prevent the condition. Relatively lower knowledge was observed regarding the underlying causes of nutritional anaemia. Only 60.00 per cent of the respondents correctly identified heavy blood loss, chronic diseases, genetic factors, and poor nutrition as major causes of anaemia.

Table 3
Attitude of the Respondents towards Nutritional Anaemia

Statements	SA	A	N	DA	SDA
Are you willing to learn about self-management of nutritional anaemia through eating healthy, balanced and nutritional diet?	41 (17.08)	80 (33.33)	86 (35.83)	27 (11.25)	6 (2.50)
Do you recognize the role of healthy diet, and a consistent daily routine in the prevention and management of anaemia?	43 (17.92)	81 (33.75)	84 (35.00)	27 (11.25)	5 (2.08)
Do you believe that self-management of the nutritional anaemia can reduce the chances of its occurrence?	35 (14.58)	86 (35.83)	90 (37.50)	27 (11.25)	2 (0.83)
Do you think it is important to regular monitor the symptoms of the nutritional anaemia for its management?	42 (17.50)	82 (34.17)	79 (32.92)	33 (13.75)	4 (1.67)
Do you think that nutrition education is good way to prevent the cause of anaemia?	36 (15.00)	84 (35.00)	85 (35.42)	33 (13.75)	2 (0.83)
Do you believe that establishing Nutri-farm and consuming its products can prevent nutritional anaemia?	45 (18.75)	75 (31.25)	77 (32.08)	38 (15.83)	5 (2.08)
Do you visit PHC/different organizations who are involved in prevention of nutritional anaemia?	36 (15.00)	90 (37.50)	87 (36.25)	25 (10.42)	2 (0.83)
Do you follow different government programs are important for nutritional anaemia awareness and prevention.	36 (15.00)	79 (32.92)	93 (38.75)	30 (12.50)	2 (0.83)
Total attitude of the respondents	28.12 (6.38)				
Low (up to 33.33)	25 (10.42)				
Medium (33.34–66.66)	115 (47.92)				
High (more than 66.66)	100 (41.67)				

The data presented in the table reveal that the respondents generally exhibited a moderately favourable attitude towards the prevention and management of nutritional anaemia. The overall mean attitude score was 28.12 ± 6.38, indicating a positive inclination toward adopting healthy nutritional practices and preventive measures. Categorization of respondents based on their attitude levels showed that 47.92 per cent belonged to the medium attitude category, followed by 41.67 per cent in the high attitude category and only 10.42 per cent in the low attitude category.

With regard to specific attitude statements, 51.67 per cent of the respondents either strongly agreed or agreed that regular monitoring of anaemia symptoms is important for effective management. Similarly, 51.67 per cent recognized the importance of maintaining a healthy diet and a consistent daily routine in

preventing and managing anaemia. About 50.41 per cent of the respondents expressed a willingness to learn self-management strategies for nutritional anaemia through healthy and balanced dietary practices. A favourable attitude was also observed regarding the role of nutrition education in anaemia prevention, with 50.00 per cent of the respondents either agreeing or strongly agreeing that nutrition education is an effective means of preventing anaemia. Likewise, 50.41 per cent believed that self-management practices can reduce the likelihood of anaemia occurrence, highlighting the respondents' confidence in preventive health behaviours. The concept of establishing Nutri-farms and consuming their products was positively perceived by 50.00 per cent of the respondents, indicating their acceptance of nutrition-sensitive agricultural approaches for improving nutritional outcomes. Furthermore, 52.50 per cent of the respondents reported favourable attitudes towards visiting Primary Health Centres (PHCs) and other organizations involved in anaemia prevention and management. This reflects their willingness to seek professional guidance and healthcare support when required. Regarding government initiatives, 47.92 per cent of the respondents agreed or strongly agreed that government programmes play an important role in nutritional anaemia awareness and prevention. However, a relatively higher proportion of respondents remained neutral on this statement, suggesting the need for improved dissemination of information about existing nutrition and health schemes. A notable observation across most statements is the relatively high percentage of respondents falling under the neutral category (32–39%), indicating uncertainty or limited conviction regarding some aspects of nutritional anaemia management.

Table 4
Practice of the Respondents towards Nutritional Anaemia

Statements	**VC**	**MC**	**C**	**NVC**	**NAAC**
In recent past, have you sought any information regarding nutritional anaemia?	20 (8.33)	50 (20.83)	90 (37.50)	65 (27.08)	15 (6.25)
Do you include all the nutrients in your diet for nutritional anaemia management?	25 (10.42)	52 (21.67)	75 (31.25)	70 (29.17)	18 (7.50)
Are you able to recognize the symptoms of nutritional anaemia?	24 (10.00)	50 (20.83)	88 (36.67)	60 (25.00)	18 (7.50)
Do you consult doctors/health workers for nutritional anaemia check-up	26 (10.83)	52 (21.67)	85 (35.42)	55 (22.92)	22 (9.17)
Are you able to follow the treatment prescribed by health workers/doctor?	15 (6.25)	60 (25.00)	80 (33.33)	60 (25.00)	25 (10.42)
Total practice	11.20 (2.68)				
Low (up to 33.33)	72 (30.00)				
Medium (33.34–66.66)	118 (49.17)				
High (more than 66.66)	50 (20.83)				

The data presented in the table reveal that the respondents demonstrated a moderate level of practice towards the prevention and management of nutritional anaemia, with an overall mean practice score of 11.20 ± 2.68. Categorization of respondents based on their practice levels indicated that nearly half of the respondents (49.17%) belonged to the medium practice category, followed by 30.00 per cent in the low practice category and only 20.83 per cent in the high practice category.

With respect to individual practices, the highest proportion of respondents (37.50%) reported that seeking information regarding nutritional anaemia was a common practice, while 20.83 per cent indicated that it was a most common practice and 8.33 per cent reported it as a very common practice. However, a considerable proportion of respondents either rarely sought information (27.08%) or did not seek information at all (6.25%). Regarding dietary management, 31.25 per cent of the respondents commonly included all essential nutrients in their diet for nutritional anaemia management, whereas 21.67 per cent and 10.42 per cent reported this practice as most common and very common, respectively. Nevertheless, nearly one-third of the respondents (29.17%) reported that such dietary practices were not very common. The ability to recognize symptoms of nutritional anaemia was reported as a common practice by 36.67 per cent of the respondents, followed by 20.83 per cent and 10.00 per cent who considered it most common and very common, respectively. However, 25.00 per cent reported that symptom recognition was not very common, reflecting the need for enhanced nutrition and health education programmes. Similarly, consulting doctors or health workers for anaemia-related check-ups was commonly practiced by 35.42 per cent of the respondents, while 21.67 per cent and 10.83 per cent reported it as most common and very common, respectively. The findings indicate a reasonably positive healthcare-seeking behaviour among respondents, although nearly one-fourth (22.92%) reported infrequent consultation and 9.17 per cent did not practice it at all. Adherence to treatment prescribed by health workers or doctors also showed a moderate trend. About 33.33 per cent of respondents reported following prescribed treatment as a common practice, while 25.00 per cent considered it most common. However, 25.00 per cent indicated that treatment adherence was not very common and 10.42 per cent reported not following prescribed treatment, highlighting an important area requiring intervention.

Table 5
Correlation between Socioeconomic variables & KAP of farm women

Variables	Knowledge (r)	Attitude (r)	Practice (r)
Age	0.048	**0.133***	0.054
Education	**0.414****	**0.509****	**0.544****
Family Size	0.022	0.115	**0.130***
Farming Experience	0.035	0.103	0.007
Time Spent in Field	-0.040	-0.013	0.031
Social Participation	**0.299****	**0.343****	**0.306****
Mass Media Exposure	**0.411****	**0.458****	**0.379****
Extension Contact	**0.253****	**0.325****	**0.294****
Dietary Diversity	**0.241****	**0.352****	**0.335****
BMI	0.078	0.068	0.061

The table presents the correlation coefficients between selected socio-economic and communication attributes of the respondents and their Knowledge, Attitude, and Practice (KAP) towards nutritional anaemia. The results indicate that several variables exhibited significant positive relationships with KAP, while others showed non-significant associations. Among the variables studied, education emerged as one of the most influential factors, exhibiting a highly significant positive correlation with knowledge (r = 0.414), attitude (r = 0.509), and practice (r = 0.544) at the 0.01 level of significance. Social participation was also found to have a highly significant positive association with knowledge (r = 0.299), attitude (r = 0.343), and practice (r = 0.306). Education enhances access to information, improves comprehension of health-related messages, and facilitates the adoption of recommended nutritional and healthcare practices. Similarly, mass media exposure showed a strong and highly significant positive relationship with knowledge (r = 0.411), attitude (r = 0.458), and practice (r = 0.379). The results further revealed that extension contact had a significant positive correlation with knowledge (r = 0.253), attitude (r = 0.325), and practice (r = 0.294). Likewise, dietary diversity exhibited a highly significant positive association with knowledge (r = 0.241), attitude (r = 0.352), and practice (r = 0.335). Among the demographic variables, age showed a significant positive correlation only with attitude (r = 0.133) at the 0.05 level of significance, indicating that older respondents tended to have slightly more favourable attitudes towards nutritional anaemia management. Family size was positively and significantly associated with practice (r = 0.130) at the 0.05 level, suggesting that respondents from larger households may have greater exposure to health-related experiences and practices. On the other hand, farming experience, time spent in the field, and BMI did not show any significant relationship with knowledge, attitude, or practice towards nutritional anaemia.

The Fig. 1 presents a correlation heatmap of study variables with Knowledge, Attitude, and Practice (KAP). The values shown in each cell are correlation coefficients (r), ranging from − 1 to + 1. A positive value indicates that two variables tend to increase together, while a negative value indicates an inverse relationship. Values closer to + 1 or − 1 represent stronger relationships, whereas values near 0 indicate weak or negligible relationships. The strongest relationship among the KAP components was observed between Attitude and Practice (r = 0.86), indicating a very strong positive correlation. This suggests that respondents with more favourable attitudes towards nutritional anaemia were also more likely to adopt appropriate preventive and management practices. A strong positive correlation was also found between Knowledge and Attitude (r = 0.79) and between Knowledge and Practice (r = 0.73). These findings indicate that greater knowledge about nutritional anaemia is closely associated with more favourable attitudes and better practices. Among the socio-economic and communication variables, education showed notable positive correlations with Knowledge (r = 0.41), Attitude (r = 0.51), and Practice (r = 0.54). This suggests that better-educated respondents tended to have greater knowledge, more favourable attitudes, and improved practices concerning nutritional anaemia. Mass media exposure was positively correlated with Knowledge (r = 0.41), Attitude (r = 0.46), and Practice (r = 0.38), highlighting the potential importance of mass media in improving awareness and promoting positive behavioural changes. Similarly, social participation showed positive correlations with Knowledge (r = 0.30), Attitude (r = 0.34), and Practice (r = 0.31). Extension contact was also positively associated with Knowledge (r = 0.25), Attitude (r = 0.32), and Practice (r = 0.29). Diet diversity demonstrated positive relationships with Knowledge (r = 0.24), Attitude (r = 0.35), and Practice (r = 0.34), indicating that respondents with better dietary diversity tended to demonstrate more favourable KAP outcomes. In contrast, variables such as age, family size, farming experience, time spent in the field, and BMI generally showed weak or negligible correlations with the KAP components. For example, age had correlations of only 0.05 with Knowledge, 0.13 with Attitude, and 0.05 with Practice. One particularly strong correlation was observed between Age and Farming Experience (r = 0.88), which is expected because older respondents generally tend to have greater farming experience. However, this high correlation should be considered carefully if both variables are simultaneously included in a multiple regression model, as it may indicate potential multicollinearity.

Discussion

The study aimed at examining the knowledge, attitude and practise of farm women towards nutritional anaemia in the north-eastern districts of Bihar also known as Seemanchal region. The findings revealed that farm women have medium knowledge, favourable attitudes, and proactive practices toward the nutritional anaemia. Positive associations were observed among KAP scores with education, extension contacts, mass media exposures and dietary diversity. Comprehensive training programs are needed to improve farm women practices in this area. The study reflected farm women had six to seven years of education. Active engagement in both agricultural and household responsibilities indicating a moderate level of literacy and formal education as supported by previous studies [24, 25]. We found that the joint type of family of farm women with active participation of on farm activities of around of nine hours

which shows that farm women play a multidimensional role in agriculture, contributing to every aspect from planting to harvesting crops and being active in associated fields. This finding aligns with studies of [26, 27]. The findings further shows moderate level of social participation, high level of mass media exposure for mobile phones and social media most used information sources and training as most frequently participated extension activities. This highlights the growing importance of digital and electronic media in disseminating information among farm women, consistent with findings from earlier research [28, 29, 30, 31]. Further the findings reveal that farm women had a fairly satisfactory knowledge of nutritional anaemia, particularly regarding its symptoms, nutrient deficiencies, and preventive measures [23, 32]. These findings highlight the argument the importance of strengthening nutrition education, health awareness campaigns, and extension interventions to improve their understanding and facilitate the adoption of appropriate preventive and management practices [33, 34]. Likewise results exhibited a moderately favourable attitude towards the prevention and management of nutritional anaemia. Their favourable attitude regarding healthy diets, nutrition education, self-management practices, healthcare utilization, and nutrition-sensitive agriculture provide a strong foundation for future interventions [35, 36]. Strengthening awareness campaigns, extension programmes, and community-based nutrition education activities can further enhance positive attitudes and encourage the adoption of appropriate preventive and management practices for nutritional anaemia [37, 38]. Moreover, study further showed a moderate level of practice towards the prevention and management of nutritional anaemia which suggests that although respondents possessed moderate knowledge and favourable attitudes towards nutritional anaemia, the translation of this knowledge into actual health-related practices was comparatively limited. There is a need for strengthening awareness and information dissemination mechanisms [39, 40]. The gap between knowledge, attitude, and practice emphasizes the need for targeted nutrition education, behaviour change communication, regular health counselling, and extension interventions. Strengthening community-based awareness programmes and promoting access to healthcare services can further enhance the adoption of appropriate practices and contribute to the reduction of nutritional anaemia among farm women [41, 42]. It can be recommended to promote online educational initiatives, empowering patients with the knowledge needed to make informed decisions, adhere to treatment plans, and actively participate in disease management. Additionally, the findings suggest that education, social participation, mass media exposure, extension contact, and dietary diversity are the key determinants influencing respondents' knowledge, attitudes, and practices towards nutritional anaemia [43, 41]. Therefore, efforts aimed at improving nutritional anaemia awareness and management should focus on strengthening educational opportunities, enhancing extension services, promoting social participation, increasing access to mass media, and encouraging diversified dietary practices among farm women. These interventions can significantly contribute to improving KAP levels and reducing the burden of nutritional anaemia in the study area.

Policy Implications

The findings of the study highlight the need for strengthening nutrition education and awareness programmes among farm women to improve their knowledge and management of nutritional anaemia.

Since education, mass media exposure, extension contact, social participation, and dietary diversity significantly influenced KAP levels, policies should focus on enhancing these factors through integrated interventions. Greater use of mobile-based advisory services, community-based awareness campaigns, and extension activities can help bridge the gap between knowledge and practice. Promoting nutrition-sensitive agriculture, kitchen gardens, and diversified diets can further improve nutritional outcomes. Additionally, coordinated efforts among the health, agriculture, and rural development sectors are essential to ensure effective anaemia prevention and management among farm women in rural areas.

Conclusion

The study revealed that farm women in the Seemanchal region of Bihar possessed moderate knowledge, favourable attitudes, and moderate practices regarding nutritional anaemia. Most respondents were young, moderately educated, and actively engaged in both agricultural and household activities. Mass media exposure, social participation, extension contact, and dietary diversity emerged as significant factors influencing their knowledge, attitudes, and practices towards nutritional anaemia. Although awareness and attitudes were relatively positive, the adoption of recommended practices remained limited, indicating the presence of a knowledge–practice gap. The findings highlight the importance of strengthening nutrition education, health awareness campaigns, and extension interventions to translate knowledge into effective action. Promoting digital learning platforms, community-based programmes, and diversified dietary practices can further enhance anaemia prevention and management among farm women. Overall, targeted capacity-building initiatives and improved access to health and nutrition information can contribute significantly to reducing the burden of nutritional anaemia in the study area.

Declarations

Clinical trial number

Not applicable

Consent for publication:

Not applicable

Ethical approval and consent to Participate:

This study involved a questionnaire-based assessment of knowledge, attitudes, and practices regarding nutritional anaemia among farm women in different districts of the Seemanchal region of Bihar, India. The study was conducted in accordance with the institutional guidelines and regulations of Bihar Agricultural University, Sabour, Bhagalpur, Bihar, India. The Institutional Ethics Committee of Dr. Kalam Agricultural College, Kishanganj, Bihar Agricultural University, reviewed the study protocol and formally waived the requirement for ethical approval, considering the non-invasive, questionnaire-based nature of the study. The protocol number was not applicable. Informed consent was obtained from all participants

before data collection. Participants were informed about the purpose of the study, the voluntary nature of their participation, and their right to withdraw at any time without providing a reason or facing any adverse consequences. Confidentiality and anonymity of participants' responses were maintained, and no personally identifying information was collected.

Conflict of interest:

The authors declare no competing interests.

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Author Contribution

KC, KDK, and SD conceived and planned the study and conducted the statistical analysis. KC and KDK drafted the manuscript. SA, P, CK, AKP, AKS, PY, and MN contributed to data collection, analysis, and critical review of the manuscript. All authors read and approved the final manuscript.Where: KC = Kevin Christopher, KDK = Krishna D K, SD = Shashikant Diwakar, SA = Shafi Afroz, P = Priyanka, CK = Chaitali Kumari, AKP = Anil Kumar Paswan, AKS = Anil Kumar Singh, PY = Pappu Yadav, MN = Mamata Nanda.

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Data Availability

Data will be made available upon request

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Figures

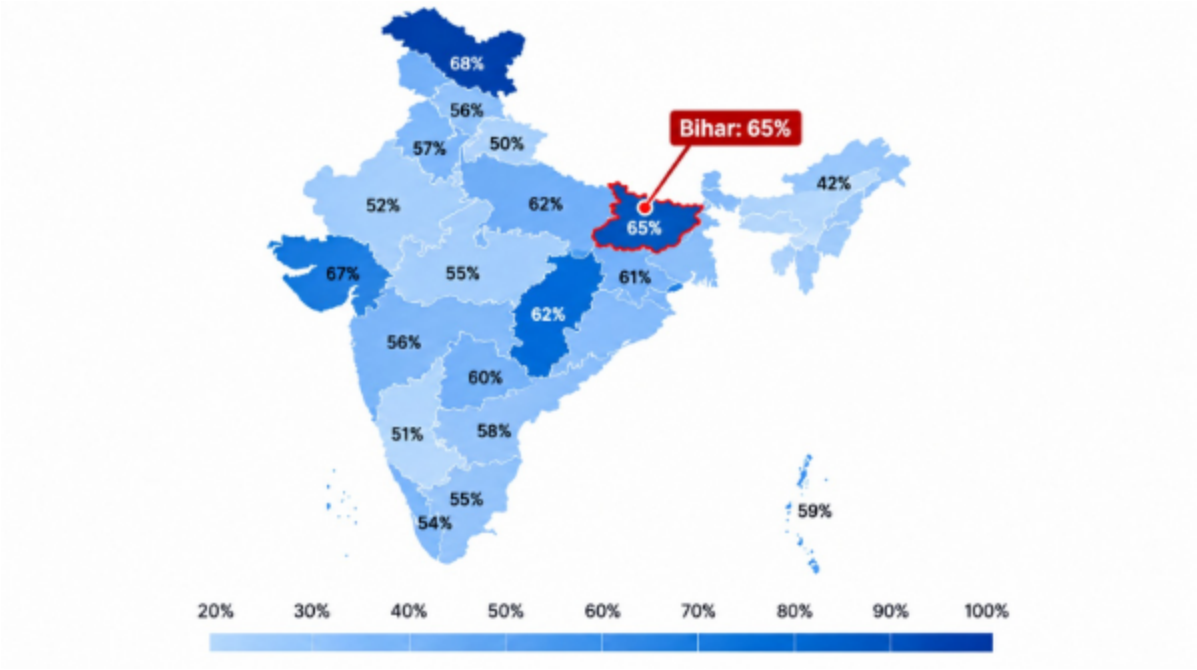


Figure 1

Anaemia prevalence among women by state

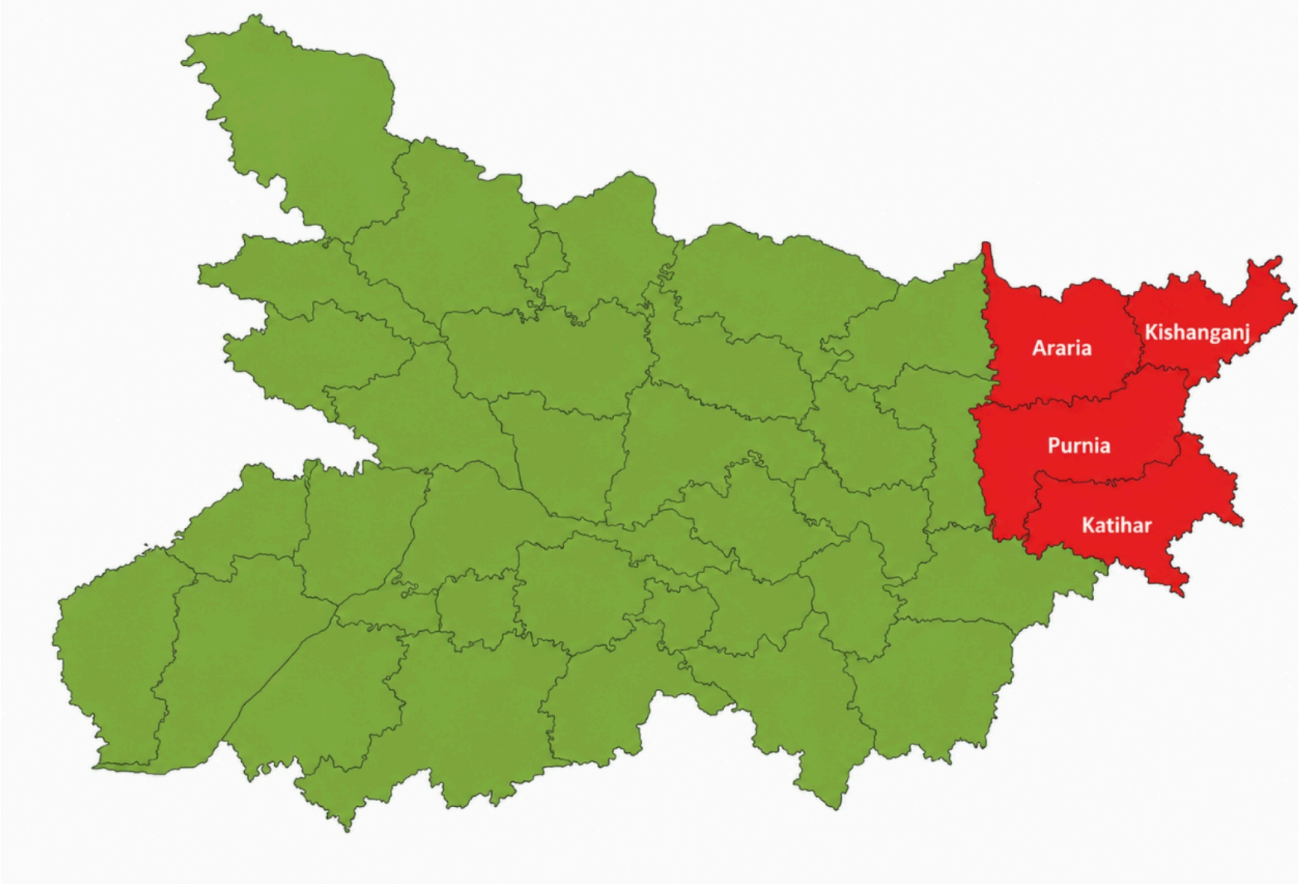


Figure 2

Anaemia affected major districts in Seemanchal region of Bihar

Source: National Family Health Survey, International Institute for Population Sciences

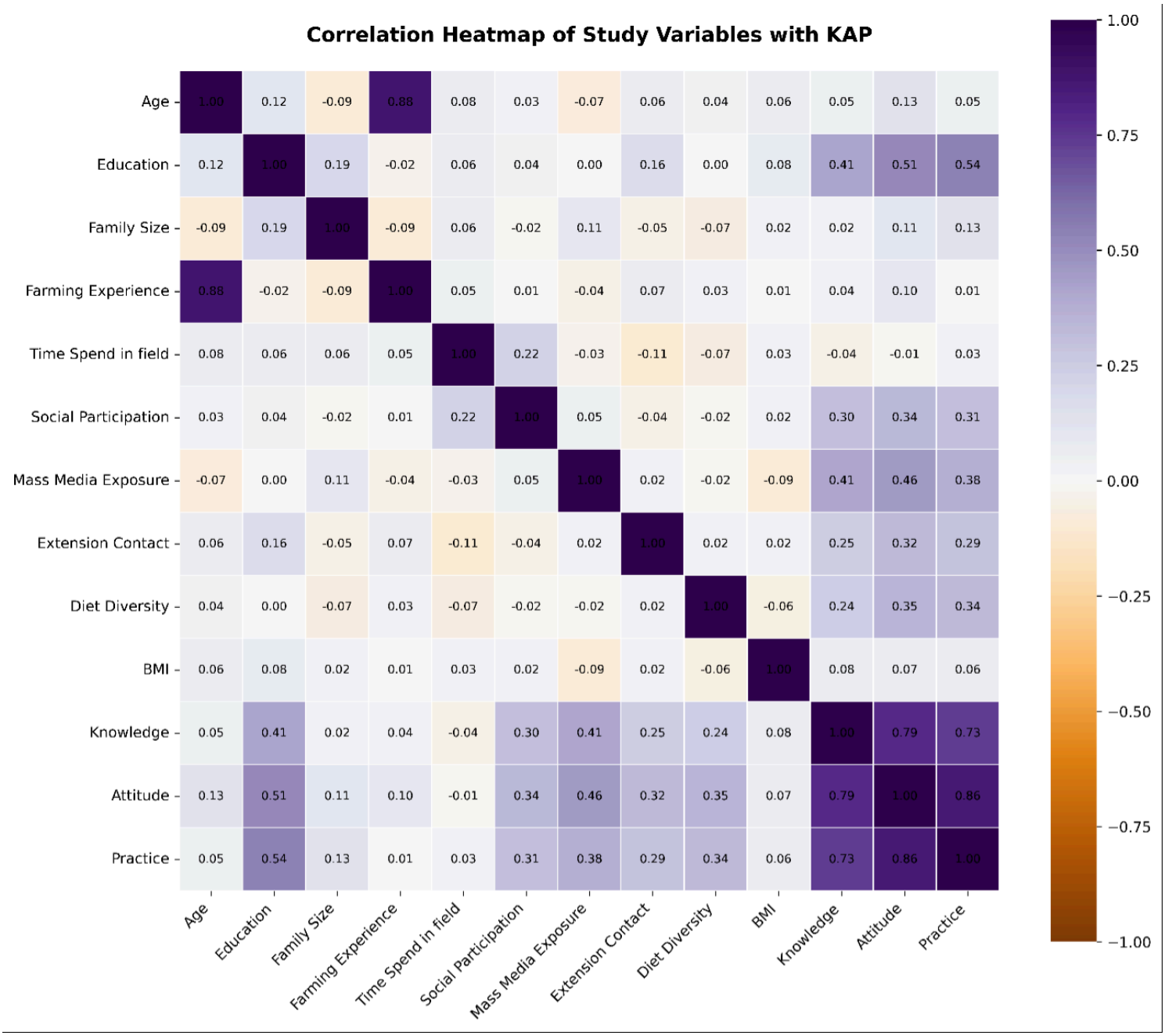


Figure 3

Fig 01. Correlation heatmap of the study variables with Knowledge, Attitude & Practices