

Effectiveness of Nutritional Counselling and Dietary Diversification on the Prevention of Anemia Among Women of Reproductive Age: A Pre-Experimental Study at a School of Nursing in Greater Noida, India

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Publication Date: 2026/10/05

Abstract:

➤ Background:

Anaemia is common among women of reproductive age, and dietary iron deficiency is its leading cause. Counselling and dietary diversification are widely recommended, but evidence from educated young women in Indian institutions is limited.

➤ Objective:

To assess the effect of nutritional counselling and dietary diversification on knowledge, dietary practice, haemoglobin, and anaemia among women of reproductive age at a school of nursing in India.

➤ Methods:

A one-group pre-test–post-test design was used with purposive sampling. Eighty-six women completed the pre-test and 73 the post-test; 57 had valid paired haemoglobin values. Knowledge (18 matched items), dietary practice (8 items, range 0–24), and haemoglobin were assessed before and after structured counselling and dietary diversification. Anaemia was defined as haemoglobin < 12.0 g/dL. Analyses used *t* tests, Wilcoxon, McNemar's, chi-square, and correlation.

➤ Results:

Participants were young, mostly urban, and educated. Mean haemoglobin rose from 12.12 to 12.58 g/dL, $t(56) = 3.57$, $p < .001$, and anaemia prevalence fell from 33.3% to 19.3% (McNemar exact $p = .008$); all anaemia was mild. The distribution of knowledge levels shifted significantly ($p = .040$) although mean knowledge, already 85.3% of the maximum at baseline, did not ($p = .182$). Dietary practice did not improve ($p = .104$). Baseline practice correlated with haemoglobin gain ($r = .33$, $p = .012$); knowledge did not ($r = .00$).

➤ Conclusion:

Counselling and dietary diversification were associated with higher haemoglobin and lower anaemia prevalence, despite no improvement in reported practice. Without a control group and with self-reported haemoglobin, controlled studies with measured iron status are needed. Counselling should be paired with practical support for supplementation.

Keywords: Anaemia, Nutritional Counselling, Dietary Diversification, Haemoglobin, Women of Reproductive Age, Anaemia Prevention.

How to Cite: Drishti Sharma; Gargi Morya; Sapam Debika Devi (2026) Effectiveness of Nutritional Counselling and Dietary Diversification on the Prevention of Anemia Among Women of Reproductive Age: A Pre-Experimental Study at a School of Nursing in Greater Noida, India. *International Journal of Innovative Science and Research Technology*, 11(9), 2688-2696. <https://doi.org/10.38124/ijisrt/26sep1367>

I. INTRODUCTION

Anemia is one of the most common nutritional disorders in the world and disproportionately affects women of reproductive age. It is defined as a deficient concentration of hemoglobin to meet the body's oxygen transport needs. For non-pregnant women, the cutoff determined by the World Health Organization (WHO, 2024) is 12.0 g/dL. The causes include iron deficiency, vitamin B12 deficiency, parasitic infection, chronic disease, and inherited disorders (Givens et al., 2024). India is a case in point for the magnitude of the problem. Despite national programs like Anemia Mukh Bharat, data from the fifth National Family Health Survey (NFHS-5) found that 57% of Indian women of reproductive age were anemic, and 61.1% in the country's Aspirational Districts (Let et al., 2024).

Their biology as women makes them particularly vulnerable. Menstruation causes recurrent iron loss, and abnormal uterine bleeding, whether heavy, prolonged or frequent, is a chronic drain on iron stores (Almuhaitb et al., 2024). Pregnancy increases demand dramatically: a non-pregnant woman needs about 1 mg of absorbed iron per day, but by the third trimester the requirement approximates 7 mg per day (Sangkhae et al., 2023). The effects are more than just tiredness, weakness and less ability to work. In pregnancy anemia is associated with maternal morbidity and mortality (Liyew et al., 2021), preterm birth and low birth weight (Habe et al., 2024).

Most anemia globally is nutritionally derived with poor dietary diversity as a key driver (Habe et al., 2024; Liyew et al., 2021). Starchy staple-based diets are low in iron, folate and vitamin B12. Women's actual diets are determined by household income, education and access to nutrient-rich foods. Hence, food-based, culturally acceptable and sustainable strategies such as dietary diversification (which involves increasing the number of different foods consumed daily) are recommended to address micronutrient deficiency (Chaudhary et al., 2022; Nair et al., 2016). But variety alone is not enough. Plant foods contain non-heme iron, which is poorly absorbed, and its absorption depends on the presence of enhancers, such as vitamin C, and limiting inhibitors (Skolmowska et al., 2022).

This information is typically obtained through nutrition counseling for women. A systematic review on counseling in low and middle-income countries showed that interactive and two-way counseling improved dietary intake more than standardized pamphlets (Dewidar et al., 2023). Counseling can also help to debunk food myths and enhance women's self-efficacy to change long-standing habits (Olloqui-Mundet et al., 2024; Tesfaye et al., 2024). But knowledge does not automatically become practice. Inadequate nutrition knowledge and poor practices continue to be a major driver of malnutrition in vulnerable communities (Beitze et al., 2024), and adherence to free iron and folic acid supplements is often low due to side effects, taste and smell of the tablets, and forgetfulness (Bahati et al., 2021; Felipe-Dimog et al., 2021). Counseling, therefore, must be judged on what women

do and what happens to their hemoglobin, rather than on what they may remember.

Most of the available data come from pregnant women in sub-Saharan Africa. There is less known about non-pregnant young women in Indian institutional settings, especially amongst educated women who are assumed to be protected by their knowledge. Few studies also look at knowledge, dietary practice and hemoglobin together, making it difficult to determine which of the three an intervention actually moves. This gap was addressed in the present study in a school of nursing, where the women are trained in the very content the counseling delivers. If knowledge is protective, then these women should be in a good position to benefit. If knowledge is not protective, then the results should identify where the pathway to prevention breaks down and that is information that nurse educators, administrators and program planners can act on directly.

The objectives were to determine baseline hemoglobin, anemia status, dietary practices and knowledge about anemia prevention; to provide nutritional counseling and dietary diversification; and to determine post-intervention hemoglobin and anemia status. The null hypothesis was that nutritional counseling and dietary diversification have no significant effect in preventing anemia among women of reproductive age.

II. METHOD

➤ Design and Setting

A one-group pre-test–post-test (pre-experimental) design was used. The study was conducted at Sharda School of Nursing Science and Research, Sharda University, Greater Noida, Uttar Pradesh, India, and data were collected in June 2026.

➤ Participants and Sampling

The target population was women of reproductive age (15–49 years) who were enrolled as students or employed as staff at the institution. Participants were recruited by purposive, non-probability sampling. Women were eligible if they could read and understand Hindi or English and gave written informed consent. Women were excluded if they had a previous diagnosis of severe anemia (hemoglobin < 7 g/dL) or were receiving intravenous iron or transfusion; were pregnant or lactating; were following a prescribed therapeutic diet or taking therapeutic high-dose iron under physician guidance; had a chronic or gastrointestinal condition that impairs iron absorption, such as celiac disease or inflammatory bowel disease; or were due to graduate, transfer, or leave the university before the post-test.

The required sample size, calculated with a statistician using the formula for proportions ($Z\alpha/2 = 1.96$; $Z\beta = 0.84$ for 80% power), was 60 women. In total, 86 women completed the pre-test and 73 completed the post-test. Usable paired hemoglobin values were available for 57 women (see Data Preparation).

➤ Intervention

The intervention combined nutritional counselling with dietary diversification. The researchers delivered structured sessions using teaching modules, visual aids, interactive discussion, and meal-planning exercises. The content covered the causes, signs, symptoms, and dietary management of anemia, and it encouraged a wider variety of locally available foods, with emphasis on iron-rich foods, vitamin C sources to enhance iron absorption, and folic acid.

➤ Instruments

Three tools were developed from the literature, expert opinion, and the investigators' own experience. The first was a demographic proforma of 18 items covering age, gender, marital status, family income, family type, residence, religion, dietary pattern, meal frequency, intake of iron-rich foods and green leafy vegetables, tea or coffee with meals, history of anemia, iron and folic acid supplementation, menstrual history, pregnancy or lactation status, awareness of anemia, and body mass index category.

The second was a knowledge questionnaire of multiple-choice items on anemia and its dietary prevention. The pre-test version contained 18 items and the post-test version 20, of which 18 corresponded one-to-one with the pre-test items. Each item scored 1 for the correct option and 0 otherwise. Only the 18 matched items were used for pre–post comparison; the two additional post-test items were analyzed separately. The third tool was a dietary practice checklist of eight statements rated *Always* (3), *Sometimes* (2), *Rarely* (1), or *Never* (0), giving a possible range of 0–24. Total knowledge and practice scores were classified into three levels by dividing each score range into bands of approximately equal width.

Content validity was established by experts in medical–surgical, community health, obstetric and gynecological, child health, and mental health nursing, who judged the relevance, adequacy, and appropriateness of each item; agreement of at least 70% was required. In a test–retest check with six women, reliability was $r = .75$ for the tools and $r = .97$ for the knowledge questionnaire. Pretesting confirmed that the items were clear, and a pilot study among six administrative staff confirmed feasibility.

Hemoglobin (g/dL) was recorded on both questionnaires. Anemia was defined as a hemoglobin concentration below 12.0 g/dL, the WHO (2024) threshold for non-pregnant women, and was graded as mild, moderate, or severe using standard WHO categories.

➤ Data Preparation

Both questionnaires carried a consent statement, and only forms bearing consent were analyzed. Hemoglobin was

entered as free text, and some participants wrote words (for example, "not tested") or physiologically impossible figures instead of a value. These entries were treated as missing, and analysis was restricted to values between 6.0 and 17.5 g/dL. Where a participant recorded a range, the midpoint was used. After screening, a valid hemoglobin value was available for 62 women before and 61 after the intervention, and for 57 women on both occasions. The paired analysis was confined to these 57 women because it isolates change within each woman. Practice scores were recalculated from the eight item responses because the researcher-use score column in the post-test file was inconsistent.

➤ Statistical Analysis

Data were analyzed in SPSS. Frequencies, percentages, means, and standard deviations described the sample and the outcomes. Hemoglobin before and after the intervention was compared with a paired t test, confirmed by the Wilcoxon signed-rank test, and the change in the proportion of anemic women was tested with McNemar's exact test. Because the knowledge and practice questionnaires could not be linked to individual women, their means were compared with independent-samples t tests and their distributions of levels with chi-square tests. The association of background variables with knowledge and practice levels at baseline was examined with chi-square tests, after merging sparse adjacent categories and using Fisher's exact test for two-by-two tables with small expected counts. Pearson's correlation coefficient was used to examine relationships among knowledge, practice, and hemoglobin. Statistical significance was set at $p < .05$.

➤ Ethical Considerations

Administrative permission was obtained from the Dean and Principal of Sharda School of Nursing Science and Research, and the study was approved by the Sharda University ethics committee. All participants gave written informed consent, and participation was voluntary.

III. RESULTS

➤ Participant Characteristics

Table 1 summarizes the 86 women assessed at baseline. The sample was homogeneous: 89.5% were aged 18–25 years, 94.2% were single, and 87.2% were undergraduates. Most belonged to nuclear families (76.7%) and lived in urban areas (70.9%), and 45.3% reported a monthly family income above ₹50,000. Half (50.0%) were vegetarian. Behaviors relevant to iron nutrition were far from optimal. Only 38.4% ate green leafy vegetables daily, 46.5% ate iron-rich foods regularly, and 43.0% drank tea or coffee immediately after meals. Nearly three quarters (73.3%) took no iron or folic acid supplement, 18.6% took one irregularly, and only 8.1% took one regularly.

Table 1 Background and Iron-Related Characteristics of Participants at Baseline (N = 86)

Variable	Category	Frequency (f)	Percentage (%)
Age (in years)	18–25	77	89.5
	26–35	9	10.5
Marital status	Single	81	94.2
	Married	5	5.8

Educational status	Under graduate	75	87.2
	Post Graduate	11	12.8
Monthly family income (₹)	Below 10,000	9	10.5
	10,001–25,000	12	14
	25,001–50,000	26	30.2
	Above 50,000	39	45.3
Type of family	Nuclear	66	76.7
	Joint	20	23.3
Place of residence	Urban	61	70.9
	Semi-urban	16	18.6
	Rural	9	10.5
Religion	Hindu	75	87.2
	Muslim	3	3.5
	Christian	5	5.8
	Others	3	3.5
Dietary pattern	Vegetarian	43	50
	Non-vegetarian	17	19.8
	Mixed diet	26	30.2
Meal frequency per day	2 meals	21	24.4
	3 meals	46	53.5
	More than 3 meals	19	22.1
Consumption of iron-rich foods	Regular	40	46.5
	Occasional	36	41.9
	Rare	10	11.6
Intake of green leafy vegetables	Daily	33	38.4
	Weekly	47	54.7
	Rarely	6	7
Tea/coffee immediately after meals	Yes	37	43
	No	49	57
Past history of anemia	Yes	13	15.1
	No	73	84.9
Iron/folic acid supplementation	Regular	7	8.1
	Irregular	16	18.6
	Not taking	63	73.3
Menstrual history	Regular	67	77.9
	Irregular	17	19.8
	Heavy bleeding	2	2.3
Pregnancy / lactation status	Neither	83	96.5
	Pregnant	2	2.3
	Lactating	1	1.2
	Weekly	47	54.7
	Rarely	6	7
Tea/coffee immediately after meals	Yes	37	43
	No	49	57
Past history of anemia	Yes	13	15.1
	No	73	84.9
Iron/folic acid supplementation	Regular	7	8.1
	Irregular	16	18.6
	Not taking	63	73.3
Menstrual history	Regular	67	77.9
	Irregular	17	19.8
	Heavy bleeding	2	2.3
Pregnancy / lactation status	Neither	83	96.5
	Pregnant	2	2.3
	Lactating	1	1.2

• *Note.* Percentages are of the 86 women assessed at baseline.

➤ Knowledge, Dietary Practice, and Hemoglobin Before and After the Intervention

• Knowledge

Baseline knowledge was high (Table 2). The mean score on the 18 matched items was 15.36 ($SD = 2.47$), or 85.3% of the maximum, and 87.2% of women were in the adequate band. Fifteen of the 18 items were answered correctly by more than 83% of participants. The weak items were the recommended frequency of iron supplementation (48.8% correct), the vitamin that aids iron absorption (46.5%), and the drink that reduces absorption (70.9%).

After the intervention, the mean score rose to 15.93 ($SD = 2.83$; 88.5% of the maximum), a difference that was not significant, $t(157) = 1.34$, $p = .182$. The distribution of knowledge levels did shift significantly, $\chi^2(2) = 6.43$, $p = .040$. The adequate band grew from 87.2% to 93.2%, and the moderate band, which held seven women at baseline, was empty at post-test. Five women (6.8%) remained in the inadequate band, compared with four (4.7%) at baseline; because the groups were not matched, these are not

necessarily the same women. The gains were largest where the baseline gaps lay: correct answers on the two weakest items rose from 48.8% to 69.9% and from 46.5% to 61.6%. On the full 20-item post-test instrument the mean was 17.74 ($SD = 3.24$), or 88.7% of the maximum.

• Dietary Practice

Reported dietary practice did not improve. The mean practice score changed from 17.72 ($SD = 3.38$) to 16.85 ($SD = 3.33$) out of 24, and the proportion with good practice fell from 64.0% to 57.5%. Neither change was significant, whether tested as a difference in means, $t(157) = -1.63$, $p = .104$, or in the distribution of levels, $\chi^2(2) = 1.04$, $p = .596$. Seven of the eight items had a slightly lower mean at post-test. The largest falls were in eating vitamin C-rich fruits (2.30 to 2.01) and in including iron-rich foods such as jaggery, dates, and pulses (2.29 to 2.08). Taking iron and folic acid supplements was the weakest item on both occasions (1.52 before, 1.42 after), well below every other item.

Table 2 Knowledge, Dietary Practice, and Hemoglobin Before and After the Intervention

Outcome	Pre-test	Post-test	Test	p
Knowledge score (0–18), M (SD) ^a	15.36 (2.47)	15.93 (2.83)	$t(157) = 1.34$	.182
Adequate knowledge, % ^a	87.2	93.2	$\chi^2(2) = 6.43$	.040
Practice score (0–24), M (SD) ^a	17.72 (3.38)	16.85 (3.33)	$t(157) = -1.63$	.104
Good practice, % ^a	64.0	57.5	$\chi^2(2) = 1.04$	.596
Hemoglobin (g/dL), M (SD) ^b	12.12 (1.35)	12.58 (1.33)	$t(56) = 3.57$	< .001
Anemia (< 12.0 g/dL), n (%) ^b	19 (33.3)	11 (19.3)	McNemar exact	.008

• Note. ^a Independent groups (pre-test $n = 86$, post-test $n = 73$); the chi-square tests compare the full distribution of levels. ^b Paired observations ($n = 57$); Wilcoxon signed-rank $p = .001$ for hemoglobin.

➤ Hemoglobin and Anemia Status

Among the 57 women with paired values, mean hemoglobin rose from 12.12 g/dL ($SD = 1.35$) to 12.58 g/dL ($SD = 1.33$), a gain of 0.46 g/dL, $t(56) = 3.57$, $p < .001$. The Wilcoxon signed-rank test confirmed the result ($p = .001$). Hemoglobin increased in 26 women (45.6%), was unchanged in 24 (42.1%), and decreased in 7 (12.3%). The prevalence of anemia fell from 19 women (33.3%) to 11 (19.3%). Eight women moved from below 12.0 g/dL to at or above it and none moved in the opposite direction (McNemar exact $p = .008$). All anemia was mild: no woman recorded a moderate or severe value on either occasion, and the number with normal hemoglobin rose from 38 to 46. Separately, the post-test questionnaire recorded a hemoglobin value for a further group of respondents, but these entries could not be linked to pre-test records and were not used in the paired analysis.

➤ Associations and Correlations

Four background variables were significantly associated with baseline outcomes (Table 3). Drinking tea or coffee immediately after meals was associated with the level of knowledge. Age, educational status, and the regularity of

iron-rich food consumption were associated with the level of dietary practice, the last being partly definitional because that behavior contributes to the practice score. Income, family type, residence, religion, dietary pattern, meal frequency, history of anemia, supplement use, menstrual history, and body mass index showed no significant association with either outcome.

Only one of the correlations examined was significant. The baseline practice score correlated moderately with the change in hemoglobin, $r = .33$, $p = .012$, so women who already practiced better dietary habits gained more. Knowledge was unrelated to the change in hemoglobin ($r = .00$, $p = .990$) and to the hemoglobin level itself ($r = -.08$, $p = .518$). Knowledge and practice were weakly and non-significantly related at baseline ($r = .18$, $p = .098$) and at post-test ($r = .22$, $p = .067$).

Table 3 Significant Associations Between Background Variables and Baseline Levels of Knowledge and Dietary Practice (N = 86)

Background variable	Outcome level	$\chi^2(2)$	p
Tea or coffee immediately after meals	Knowledge	12.45	.002
Age	Dietary practice	9.03	.011
Educational status	Dietary practice	7.00	.030
Regular iron-rich food consumption	Dietary practice	6.30	.043

- *Note.* Categories with few respondents were merged before testing. All other background variables were non-significant.

IV. DISCUSSION

➤ *Principal Findings*

This study asked whether nutritional counselling and dietary diversification were associated with better knowledge, dietary practice, and hemoglobin among women of reproductive age in a school of nursing. The clearest result was biological. Among 57 women with paired values, mean hemoglobin rose by 0.46 g/dL and the prevalence of anemia fell from 33.3% to 19.3%, with eight women leaving the anemic range and none entering it. Knowledge was already high and shifted mainly at the margins, while reported dietary practice did not improve. Baseline practice, but not knowledge, predicted who gained hemoglobin. The null hypothesis was therefore rejected for the hemoglobin outcome but not for reported practice.

➤ *Hemoglobin*

The rise in hemoglobin is consistent in direction with other nutrition-based interventions, though smaller than in some. Anato and Reshid (2025) combined nutrition education with iron and folic acid supplements in pregnant women in Ethiopia and observed hemoglobin rising from 11.78 to 12.65 g/dL, with anemia falling from 27.8% to 7.2% in the intervention group against 27.1% to 17.7% in controls. Their larger effect is unsurprising, because their programme supplied the supplement alongside education and their participants, being pregnant, faced greater physiological demand. A systematic review of randomized trials also found that dietary interventions for iron-deficiency anemia in women, including counselling alone, improved hemoglobin, provided that iron sources were paired with enhancers such as vitamin C and inhibitors were limited (Skolmowska et al., 2022). The present result adds a data point from a young, comparatively advantaged population with mild anemia.

The finding must nevertheless be read with care. There was no control group, so the change cannot be attributed to the intervention with confidence; regression toward the mean, seasonal variation, and other concurrent influences could each contribute. Hemoglobin was also reported by participants rather than measured under study conditions, and it is possible that women who supplied valid values on both occasions differed from those who did not. Anemia was mild throughout, so the results say nothing about moderate or severe disease.

➤ *An Educated, Low-Risk Group that was Still Anemic*

The baseline profile deserves attention in its own right. In national data, poverty, tribal status, underweight, and low education were the main risk factors for anemia among Indian women, and higher education and exposure to mass media were protective (Let et al., 2024). Nearly every protective characteristic was present in this sample, yet a third of the women with a baseline value were anemic. Education, urban residence, and household income did not protect them, and the reason is visible in their own reported behavior: almost three quarters took no iron or folic acid supplement, more than two in five drank tea or coffee straight after meals, and fewer than two in five ate green leafy vegetables daily. Being trained as a nurse, and therefore knowing about anemia, is evidently not the same as being protected from it.

➤ *Knowledge*

The modest knowledge gain reflects the starting point rather than a weak intervention. With a baseline mean at 85.3% of the maximum, the instrument left little headroom, so the average barely moved even as the distribution changed significantly. Studies that began from lower baselines recorded much larger gains. In Ethiopia, the proportion of pregnant women with good knowledge rose from 48.5% to 84.5% after six bi-weekly education sessions (Anato & Reshid, 2025). Among rural women in Uttarakhand, where 63–68% had low nutrition knowledge at baseline, mean knowledge scores in a multimedia group rose from 27.83% to 64.79% (Upadhyay et al., 2011). Read alongside these studies, the present gains were concentrated exactly on the three items that were weak at baseline, which is where counselling had something to add.

High knowledge coexisting with poor practice is well documented. Among 149 women of reproductive age in urban Dhaka, 53.75% had adequate knowledge of iron-deficiency anemia and most could name iron-rich foods, yet every participant fell below the recommended iron intake, averaging 10.95 mg against a requirement of 18 mg (Sarwer et al., 2025). The present sample reproduced that gap, and more sharply, since these women were better educated and scored higher on knowledge. Together, these findings support the view that information is necessary but not sufficient for change (Beitze et al., 2024).

➤ *Dietary Practice*

Reported dietary practice did not improve, and supplement use remained the weakest behavior. This is consistent with evidence that dietary and supplementation behaviors respond to different interventions. In Anato and Reshid's (2025) trial, iron and folic acid adherence reached 79.4% in the intervention group against 40.6% in controls, but the programme supplied the tablets as well as the

education. Similarly, in a study of 198 pregnant women in northern Jordan, women with higher dietary diversity had higher hemoglobin, but the differences were not significant, and the authors concluded that a diverse diet works best alongside oral iron and food fortification rather than in place of them (Al-Bayyari et al., 2024). Counselling that is interactive rather than informational is more likely to change intake (Dewidar et al., 2023), and future sessions may need more practice-oriented elements such as tasting, cooking, and problem-solving around barriers.

Several explanations for the flat practice scores should be weighed. The pre-test and post-test groups differed in size and were not individually matched, so part of the downward drift may reflect a different mix of respondents. Counselling may also have made women stricter judges of their own diets, so that a behavior once recorded as *Always* was later recorded as *Sometimes*. An eight-item self-report scale cannot separate a genuine decline from more honest reporting, and it may be too coarse to register real change. What can be said is that the intervention produced no demonstrable improvement in reported behavior.

➤ *How Knowledge, Practice, and Hemoglobin Relate*

The correlations sharpen the picture. Baseline practice predicted hemoglobin gain, whereas knowledge did not, and the two were only weakly related. In this sample, therefore, the pathway from information to hemoglobin appears to run through behavior. An intervention that raises knowledge without changing behavior has no reliable claim on the biological outcome, and the women who benefited most were those already eating well. That raises an equity concern: programmes of this kind may benefit those who need them least, and future studies should test whether differently designed counselling can reach women whose practice is poorest.

The data also leave a puzzle. Hemoglobin improved while reported diet did not. Either real dietary change occurred and the self-report instrument failed to capture it, or the benefit arose through a pathway that was not measured, or the hemoglobin change partly reflects measurement and selection effects described above. These data cannot distinguish between the possibilities, and resolving the question needs a more sensitive dietary assessment, such as a dietary diversity score or repeated dietary recall, together with measures of iron status beyond hemoglobin.

V. IMPLICATIONS

For nursing practice, high knowledge should not be taken as evidence of low risk. Screening should rest on hemoglobin and reported behavior, and nurses should ask directly about iron and folic acid use, treating non-adherence as the default to be checked. Drinking tea or coffee straight after meals is a specific, cost-free behavior that counselling can address by name. For nursing education, teaching anemia as a body of knowledge does not by itself produce nurses who apply it to their own health, so curricula should pair theory with self-assessment and behavior-change skills, and should explicitly cover the residual gaps found here: supplement

frequency, the role of vitamin C, and the inhibiting effect of tea and coffee. For administration, institutions should consider pairing counselling with an accessible supply of weekly iron and folic acid tablets, a simple record of uptake, and periodic hemoglobin screening of female students and staff. For research, the priority is a controlled trial with individually linked measurements, a validated dietary diversity score, and biochemical markers such as serum ferritin, so that the effect of counselling on anemia can be separated from other influences and the mechanism identified.

VI. LIMITATIONS

This study has several limitations. First, the one-group design has no comparison group, which limits causal inference. Second, the pre-test and post-test questionnaires could not be linked to individuals, so the knowledge and practice comparisons are between groups and are weaker than the paired hemoglobin comparison. Third, the hemoglobin analysis rests on 57 of the participants because many entries were unusable, and values were participant-reported rather than measured by the research team. Fourth, knowledge and practice were self-reported and open to social desirability bias, and the eight-item practice scale was brief. Fifth, the follow-up was short, so the durability of any change is unknown. Sixth, the sample was drawn from one school of nursing and was homogeneous in age, marital status, education, and income, which limits generalizability and gave the association tests little power. Against these limitations, the study measured a biological outcome alongside knowledge and practice, analyzed hemoglobin in a paired design in which each woman served as her own comparison, documented how missing and implausible values were handled, and reported null findings openly. Future studies should use a controlled design, laboratory-measured hemoglobin with additional iron markers, individually linked questionnaires, and longer follow-up.

VII. CONCLUSION

Nutritional counselling and dietary diversification were associated with a significant rise in hemoglobin and a significant fall in the prevalence of anemia among women of reproductive age in a school of nursing, and with a modest shift in the distribution of knowledge on a ceiling-limited instrument. Reported dietary practice did not improve, and supplement uptake remained the weakest behavior. Because the design was uncontrolled and hemoglobin was self-reported, these results should be treated as promising rather than conclusive. Programmes should pair counselling with practical support for supplementation and be evaluated against measured hemoglobin in controlled designs, so that gains in knowledge are not mistaken for protection.

ACKNOWLEDGMENTS

The authors thank the Associate Dean of Sharda School of Nursing Science and Research, the participants, and the experts who validated the tools.

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