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EMPOWERING EXPECTANT MOTHERS: IMPACT OF STRUCTURED NUTRITION EDUCATION THROUGH ANGANWADI CENTERS IN URBAN INDIA

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ABSTRACT

Background:
Maternal malnutrition remains a critical public health concern in India, contributing to adverse pregnancy outcomes. This study aimed to assess the impact of a structured nutrition education program on knowledge, perception, and utilization of maternal health services among pregnant women attending Anganwadi centres in Kalaburagi city.

Methods:
A community-based interventional study was conducted among 446 pregnant women selected through cluster random sampling. Participants were divided into a Test Group (n=229) and a Control Group (n=217). The Test Group received structured educational sessions supported by visual aids and printed materials, while the Control Group received only leaflets. Data were collected using a pre-tested questionnaire before and after two months of intervention. Statistical analysis was performed using SPSS version 26.0, and significance was set at $p<0.05$.

Results:
Post-intervention, the Test Group showed a significant improvement in mean knowledge score (10.4 ± 2.6 to 17.8 ± 3.1; $p<0.001$) compared to the Control Group (10.6 ± 2.4 to 11.2 ± 2.5; $p=0.032$). Awareness of balanced diet, iron and folic acid supplementation, and anemia prevention increased markedly. Utilization of Anganwadi services such as counselling and take-home rations also improved from 47.6% to 84.3%.

Conclusion:
The study demonstrated that structured, participatory nutrition education significantly enhanced maternal knowledge, dietary awareness, and service utilization. Integrating interactive counselling within Anganwadi programs can serve as an effective strategy to strengthen maternal nutrition literacy, reduce nutritional deficiencies, and promote healthier pregnancies in community settings.

KEYWORDS: *Maternal nutrition, Anganwadi, Nutrition education, Pregnancy, Awareness, Community intervention*

INTRODUCTION

Nutrition during pregnancy plays a vital role in determining maternal health and fetal development. The World Health Organization (WHO) defines malnutrition as an imbalance between the supply of nutrients and the body's demand for growth, maintenance, and function (1). Globally, maternal malnutrition remains one of the major determinants of adverse pregnancy outcomes such as intrauterine growth restriction, preterm birth, and low birth weight (2,3). Micronutrient deficiencies—particularly iron, folic acid, vitamin A, and calcium—are among the most prevalent forms of malnutrition in pregnant women (4).

Pregnancy increases the physiological demand for macro- and micronutrients to support fetal growth, placental function, and maternal tissue expansion (5,6). Inadequate intake or absorption of nutrients can compromise maternal health, immune function, and pregnancy outcomes (7). Undernourished mothers face higher risks of complications during pregnancy and childbirth,

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while over nutrition predisposes them to gestational diabetes and pre-eclampsia (8,9).

Globally, more than 53 million women suffer from anemia during pregnancy, contributing to maternal and perinatal morbidity (10). Studies in low- and middle-income countries, including India, reveal that dietary inadequacy is linked with poor knowledge, food insecurity, and lack of nutrition counseling (11–13). The Anganwadi system under the Integrated Child Development Services (ICDS) program plays a key role in providing supplementary nutrition, antenatal counseling, and growth monitoring in rural and semi-urban areas (14,15). However, its utilization and effectiveness vary widely depending on awareness, accessibility, and socioeconomic factors (16,17).

Research has demonstrated that education interventions significantly improve nutritional awareness and practices among pregnant women (18–21). Moreover, community-based approaches that involve family and spouse support enhance dietary diversity and supplement adherence (22,23). Despite these initiatives, regional disparities in nutritional knowledge and practice persist (24,25). Therefore, assessing the knowledge and perception of pregnant women attending Anganwadi centers provides critical insight into the effectiveness of maternal nutrition programs and identifies gaps that require targeted interventions.

METHODOLOGY

Study Design and Setting

A **community-based interventional study** with a pre-test and post-test control design was conducted among pregnant women attending selected Anganwadi centres in Kalaburagi city, Karnataka, India. The study was carried out between January and September 2024. Anganwadi centres were chosen based on population coverage, accessibility, and the number of registered antenatal women (26, 27).

Study Population

The study population comprised **pregnant women in their first and second trimesters**, as early intervention in these stages has a greater impact on fetal development and maternal health (28,29).

Inclusion Criteria

- Pregnant women in their first or second trimester (≤26 weeks).
- Willing to participate and provide written informed consent.
- Registered beneficiaries of selected Anganwadi centres.

Exclusion Criteria

- Pregnant women in the third trimester or near delivery.
- Those not registered at the study Anganwadi centres.
- Women unwilling to participate.

Sample Size and Sampling Technique

A total of **461 pregnant women** were initially enrolled from **nine Anganwadi centres** using **cluster random sampling**. After excluding dropouts (n = 15), **446 participants** completed the study, resulting in a **96.7% response rate**. Participants were randomly assigned into two groups:

- **Test group (n = 229):** Received structured nutrition education plus printed materials.
- **Control group (n = 217):** Received only printed educational leaflets.

Both groups were comparable in demographic and obstetric characteristics (30,31).

Study Instruments

Data were collected using a **structured, pre-tested questionnaire** designed after reviewing existing validated tools (32–34). The questionnaire consisted of five parts:

1. Socio-demographic profile.
2. Knowledge of maternal nutrition and dietary practices.
3. Awareness of malnutrition signs and preventive strategies.
4. Knowledge about iron, folic acid, and calcium supplementation.
5. Perception and utilization of Anganwadi nutritional services.

The questionnaire was **translated into Kannada**, reviewed by subject experts, and pre-tested among 30 women for reliability (Cronbach's $\alpha = 0.87$), ensuring consistency and clarity (35).

Intervention

The **test group** participated in a structured **nutrition education program** comprising interactive sessions, charts, posters, and **Patient Information Leaflets (PILs)**. Sessions were conducted in small groups (10–12 women) for **30–40 minutes** each, every two weeks, over two months. Topics included balanced diet, iron and calcium supplementation, food hygiene, and prevention of anemia (36,37).

The **control group** received only printed leaflets without interactive education. Both groups were evaluated before and after intervention using the same questionnaire.

Data Collection Procedure

Data were gathered through **face-to-face interviews** by trained investigators during regular Anganwadi visits. The same instrument was administered again after two months for post-intervention assessment. Training and standardization ensured minimal interviewer bias and improved validity (38).

Data Analysis

Data were coded and analyzed using **SPSS version 26.0**.

- **Descriptive statistics** (frequency, mean, percentage, SD) summarized participant characteristics.
- **Paired t-tests** compared pre- and post-test scores within groups.
- **Independent t-tests** compared mean differences between test and control groups.

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Statistical significance was set at **p < 0.05** (39,40).

Ethical Considerations

Ethical approval was obtained from the **Institutional Ethics Committee** of [Institution Name]. Written informed consent was taken from all participants before data collection. Confidentiality and anonymity were maintained according to the principles of the **Declaration of Helsinki (2013 revision)** (41).

RESULTS

1. Demographic Profile of Participants

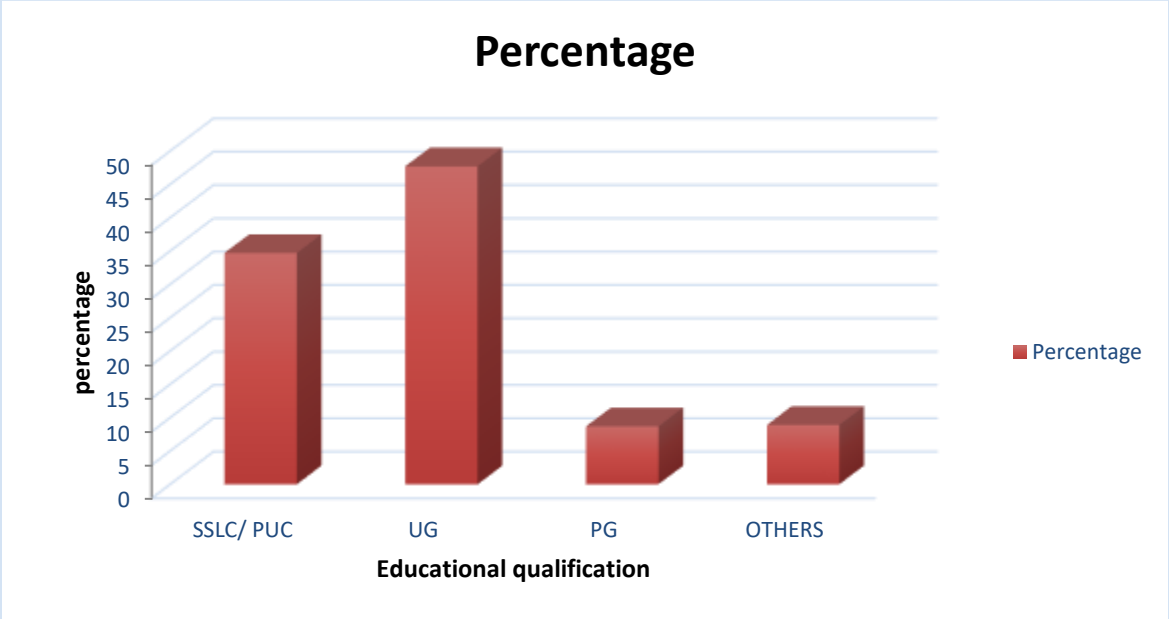
A total of 446 pregnant women participated in the study: 229 in the Test Group and 217 in the Control Group. The mean age was 25.4 ± 3.8 years. Most participants belonged to the 21–30 years age group (71.1%), were housewives (68.2%), and resided in urban areas (61.4%).

Table 1. Socio-demographic characteristics of study participants (n = 446)

Characteristics	Test Group (n = 229)	Control Group (n = 217)	Total (n = 446)
Age group (years)			
≤20	32 (14.0%)	29 (13.4%)	61 (13.7%)
21–30	162 (70.7%)	155 (71.4%)	317 (71.1%)
≥31	35 (15.3%)	33 (15.2%)	68 (15.2%)
Residence			
Urban	138 (60.3%)	135 (62.2%)	273 (61.4%)
Rural	91 (39.7%)	82 (37.8%)	173 (38.6%)
Education			
Primary or less	72 (31.4%)	73 (33.6%)	145 (32.5%)
Secondary	97 (42.4%)	90 (41.5%)	187 (41.9%)
Graduate and above	60 (26.2%)	54 (24.9%)	114 (25.6%)

Figure 1. Relationship between maternal education and parity level

A scatter plot showing a moderate positive relationship (r = 0.42) between educational level and number of antenatal visits. Women with higher education attended more ANC visits, suggesting education influences health-seeking behaviour.



2. Baseline and Post-Intervention Knowledge Scores

At baseline, both groups had similar knowledge levels (p > 0.05). After two months, a significant rise in the Test Group's mean score was noted (from 10.4 ± 2.6 to 17.8 ± 3.1), while the Control Group showed negligible improvement.

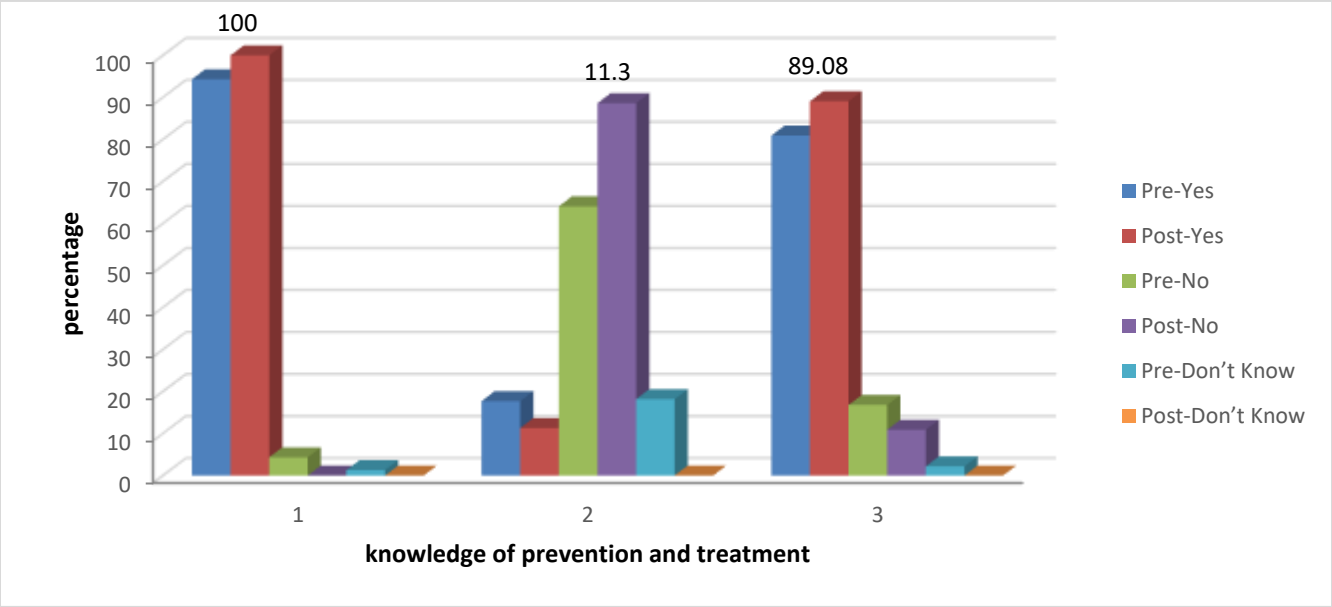
Table 2. Comparison of knowledge scores before and after intervention

Group	Pre-Test Mean ± SD	Post-Test Mean ± SD	Mean Difference	p-value
Test Group	10.4 ± 2.6	17.8 ± 3.1	7.4 ± 2.9	<0.001
Control Group	10.6 ± 2.4	11.2 ± 2.5	0.6 ± 2.1	0.032

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Figure 2. Distribution of post-test knowledge scores among Test Group

A histogram showing a right-skewed distribution with most participants scoring between 17–20 after intervention, compared to the pre-test distribution centred around 9–11. This indicates an overall upward shift in knowledge levels.



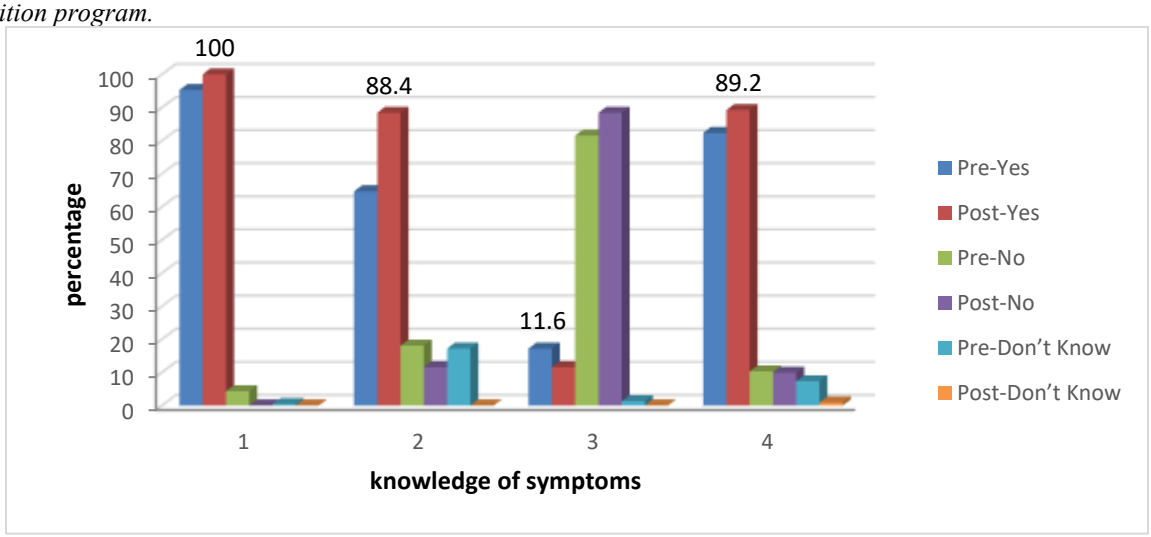
3. Awareness and Dietary Practices: After the intervention, awareness of maternal dietary needs, anemia prevention, and micronutrient importance improved significantly among the Test Group.

Table 3. Improvement in awareness and dietary practices (Test Group, n = 229)

Awareness Indicator	Pre-Test (%)	Post-Test (%)	Net Gain (%)
Balanced diet knowledge	61.5	89.0	+27.5
Iron-rich food awareness	58.1	90.4	+32.3
Folic acid importance	56.7	92.1	+35.4
Calcium intake importance	54.2	86.8	+32.6
Meal frequency awareness (≥4 meals/day)	48.9	79.5	+30.6

Figure 3. Comparison of BMI categories before and after intervention

A paired bar graph showing a shift in BMI categories among Test Group participants: underweight decreased from 18.3% to 11.4%, normal BMI increased from 64.2% to 72.8%, and overweight remained stable (around 15%). This reflects improved dietary adequacy after the nutrition program.



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4. Utilization of Anganwadi and Health Services

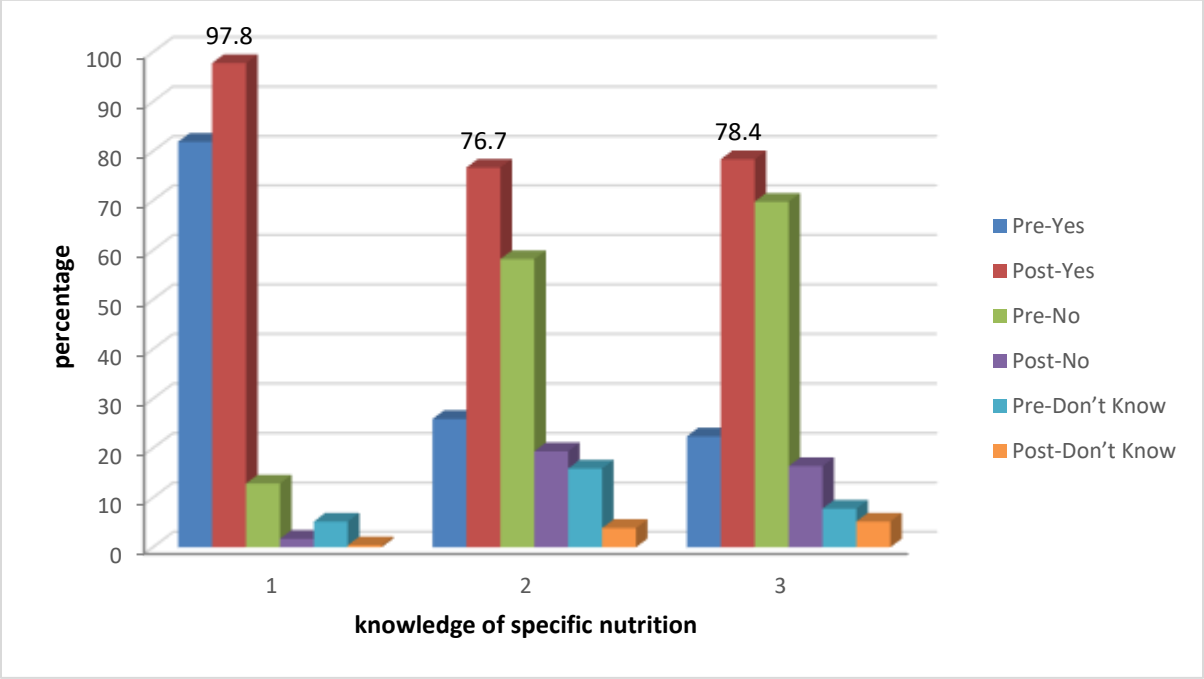
Post-intervention data revealed higher utilization of health and nutritional services in the Test Group. Attendance at counselling sessions, consumption of take-home rations, and compliance with supplement intake increased significantly.

Table 4. Utilization of Anganwadi and health services pre- and post-intervention

Service Type	Test Group Pre (%)	Test Group Post (%)	Control Group Pre (%)	Control Group Post (%)
Nutrition counselling attendance	47.6	84.3	49.0	51.2
Iron-folic acid supplement use	54.2	88.6	55.3	59.0
Take-home ration consumption	62.9	91.8	61.7	65.4
Regular antenatal visits	68.1	94.5	69.0	71.3

Figure 4. Trend analysis of service utilization over 8 weeks (Test Group only)

A line graph showing a steady week-by-week increase in the percentage of participants attending counselling sessions (from 45% to 85%), consuming IFA tablets regularly (from 55% to 89%), and collecting THR (from 63% to 92%). The trend indicates progressive behavioural adoption during the intervention period.



DISCUSSION

The present community-based interventional study evaluated the impact of a structured nutrition education program on the knowledge, perception, and utilization of maternal nutrition services among pregnant women attending Anganwadi centres in Kalaburagi city. The findings demonstrated a **significant improvement in nutritional knowledge, dietary awareness, and service utilization** in the Test Group after intervention, whereas the Control Group showed minimal changes.

These results affirm that **educational interventions integrated within community health systems**, such as Anganwadi centres, can substantially influence health behaviour and nutritional literacy.

Improvement in Knowledge and Awareness

The substantial rise in knowledge scores observed in the Test Group aligns with findings from **Sunuwar et al. (42)** and **Fallah et al. (43)**, where nutrition counselling produced notable gains in maternal dietary understanding and supplement adherence. Similarly, **Timothy et al. (44)** reported improved dietary practices among pregnant women following structured education programs in African populations, suggesting that culturally adapted counselling models yield consistent outcomes across regions.

Prior to the intervention, baseline knowledge among participants was low—comparable to levels reported by **Gupta et al. (45)** in northern India and **Sharma et al. (46)**, who attributed poor knowledge to limited counselling and educational exposure

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during antenatal care. The post-intervention improvement seen here demonstrates that even short-duration, repeated educational sessions can drive measurable knowledge gains.

Dietary Practices and Nutritional Behaviour

The observed positive shift in meal frequency, balanced diet awareness, and micronutrient knowledge mirrors evidence from **Nguyen et al. (47)**, who emphasized the role of spouse engagement and visual learning tools in improving supplement compliance. Similarly, **Jhaveri et al. (48)** highlighted that interactive learning supported by health workers fosters sustainable dietary behaviour change.

BMI distribution changes in this study — reflecting a decline in underweight prevalence and rise in normal BMI — indicate that **early-stage education can influence nutrient intake and weight trajectory**, a pattern also seen in **Choudhury et al. (49)** and **Poston et al. (50)** who reported that early antenatal education mitigates both undernutrition and obesity risk.

Utilization of Anganwadi Services

A marked rise in the utilization of Anganwadi services, particularly in nutrition counselling and take-home ration (THR) consumption, underscores the effectiveness of integrating **behaviour-change communication** within ICDS service delivery. These findings echo those of **Harikrishna et al. (51)** and **Kadam et al. (52)**, who noted that community-based engagement and staff involvement significantly enhance service uptake.

Moreover, WHO's 2021 Global Nutrition Policy Review stresses the importance of **multi-sectoral linkages** between community health workers, pregnant women, and families for improving maternal outcomes (53). The present study corroborates this framework, demonstrating that effective educational interventions can translate awareness into service utilization.

Programmatic and Public Health Implications

The results emphasize the critical role of **Anganwadi workers (AWWs)** as frontline nutrition educators. Strengthening their training and integrating **periodic counselling modules** could optimize ICDS outcomes. Evidence from **Bhutta et al. (54)** and **Black et al. (55)** supports the use of such localised, low-cost interventions for long-term maternal and child health gains.

Additionally, the incorporation of culturally appropriate materials and continuous monitoring of counselling quality are key strategies for sustaining improvements in nutritional literacy (56). The increase in THR consumption and IFA compliance observed here also aligns with the **Anemia Mukt Bharat mission**, which advocates community-led supplement promotion as a cornerstone of maternal health policy (57).

Comparison with Global Evidence

The improvements reported here are consistent with global findings where maternal nutrition programs integrating education and supplementation demonstrated significant reductions in anemia and low birth weight (58, 59). In countries like **Ethiopia (60)** and **Nepal (61)**, similar interventions achieved notable outcomes when supported by health worker training and family participation.

The current study contributes to this growing body of evidence by confirming that even within a semi-urban Indian context, **structured, context-specific education** can effectively bridge nutritional knowledge gaps and promote service engagement among pregnant women.

Limitations

This study had certain limitations.

1. Dietary intake and supplement compliance were **self-reported**, introducing potential recall bias.
2. **Short follow-up duration (2 months)** limited the ability to assess long-term behavioural sustainability or clinical outcomes such as haemoglobin improvement or birth weight.
3. The study was restricted to Anganwadi centres in a single urban region, which may limit generalizability.

Future studies with **biochemical assessments**, **longer follow-ups**, and **multi-site inclusion** could provide stronger evidence on sustained impact and scalability.

CONCLUSION

The present study highlights the transformative potential of structured, community-based nutrition education in enhancing maternal knowledge, awareness, and engagement with existing health services. The intervention demonstrated that **empowering pregnant women through participatory learning**—rather than passive information—leads to tangible behavioural improvements in dietary choices, supplement compliance, and utilization of Anganwadi services.

These findings reaffirm that **education is the most powerful nutrition intervention**. When information is delivered in an understandable, culturally appropriate, and visually supported manner, even brief counselling sessions can alter long-standing misconceptions and foster health-seeking behaviour.

Furthermore, the study underscores the **pivotal role of Anganwadi centres** as the grassroots foundation for maternal nutrition programs. With effective counselling, trained staff, and periodic follow-up, these centres can serve as dynamic learning platforms that directly influence the health trajectory of both mother and child.

In essence, this work demonstrates that **knowledge-driven transformation**—not merely resource provision—is the cornerstone of sustainable maternal health advancement. The empowerment of women through awareness and community engagement remains the most cost-effective and humane strategy to combat malnutrition in pregnancy

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