Nutritional Health Status of Pregnant Women in the Nashik Region: A Cross-Sectional Survey with Anthropometric and Biochemical Assessment

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Abstract

Background: Maternal undernutrition remains a critical public-health concern in India, with varying regional disparities. The Nashik region, a rapidly urbanizing district of Maharashtra, continues to report nutritional vulnerabilities among pregnant women.

Objective: To assess the dietary patterns, anthropometric indicators, and biochemical nutritional status of pregnant women in the Nashik region and identify determinants of poor maternal nutrition.

Methods: A community-based cross-sectional survey was conducted among **320 pregnant women**, selected using multistage sampling. Data collection included a structured dietary questionnaire, 24-hour dietary recall, anthropometric measurements (weight, BMI, MUAC), and biochemical markers (hemoglobin, serum iron, ferritin, and calcium). Descriptive statistics, chi-square tests, and logistic regression were used.

Results: Almost half of the participants (47.5%) were underweight based on MUAC. **Anemia prevalence was 62.1%**, with 28.7% exhibiting moderate to severe anemia. Micronutrient deficiency was common: low serum iron (42.8%), low ferritin (37.2%), and hypocalcemia (23.1%). Dietary assessment revealed inadequate intake of green leafy vegetables (68%), fruits (72%), and protein-rich foods (54%). Low socioeconomic status and inadequate dietary diversity were significantly associated with anemia ($p < 0.01$).

Conclusion: Nutritional vulnerabilities remain widespread among pregnant women in Nashik, with high anemia and micronutrient deficiencies. Strengthening supplementation programs, improving dietary diversification, and targeted counseling are essential to improve maternal outcomes.

Keywords: pregnancy, nutrition, anemia, anthropometry, biochemical markers, Nashik, India.

1. Introduction

Maternal nutrition plays a decisive role in determining pregnancy outcomes, fetal development, and the long-term health trajectory of both mother and child. Adequate intake of macronutrients and micronutrients during pregnancy is essential to support physiological changes, immune function, and optimal placental growth. Globally, maternal undernutrition continues to account for a substantial proportion of preventable maternal and neonatal morbidity. In low- and middle-income countries, nutritional deficiencies are often compounded by poverty, inadequate food access, limited dietary diversity, and restricted utilization of health services.

India continues to grapple with widespread nutritional challenges, particularly among pregnant women. Despite the scale-up of national programs such as the **Pradhan Mantri Matru Vandana Yojana (PMMVY)**, **Integrated Child Development Services (ICDS)**, and **Anemia Mukt Bharat (AMB)**, undernutrition and anemia remain highly prevalent. Data from NFHS-5 indicate that **over half of Indian women of reproductive**

age are anemic, with pregnant women disproportionately affected. These persistent deficiencies highlight gaps in implementation, awareness, food security, and adherence to supplementation.

The Nashik region of Maharashtra exhibits unique nutritional vulnerabilities due to its mixed demographic profile comprising tribal populations, peri-urban settlements, agricultural households, and urban slums. Socioeconomic disparities, cultural dietary restrictions, early marriage, multiparity, and limited decision-making autonomy among women can further compromise nutritional wellbeing. While urban pockets of Nashik show improving health indicators, rural and tribal blocks remain underserved, with limited access to diversified foods, antenatal counseling, and biochemical screening.

Scientific literature emphasizes the need to evaluate maternal nutritional status using **multidimensional assessments**, integrating dietary patterns, anthropometric indicators, and biochemical markers. Anthropometric measurements such as **MUAC and BMI** provide rapid insights into long-term energy deficiencies, while biochemical parameters—including **hemoglobin, ferritin, serum iron, and calcium**—offer a clearer understanding of underlying micronutrient insufficiencies. However, region-specific data from Nashik integrating these domains remain scarce.

Given these gaps, a comprehensive assessment of the nutritional status of pregnant women in Nashik is crucial for strengthening antenatal care, tailoring local nutrition interventions, and informing district-level policy planning. This study therefore aims to evaluate dietary intake, anthropometric measures, and biochemical markers among pregnant women in the Nashik region, and to identify determinants of poor nutritional health within this population. By generating localized evidence, the study contributes to more targeted, context-specific maternal health strategies.

2. Literature Review

Maternal undernutrition has been widely documented as a public-health challenge in India. Studies from the **National Family Health Survey (NFHS-5)** report that nearly 57% of Indian women aged 15–49 are anemic, with higher prevalence among pregnant women. Research conducted in Maharashtra indicates persistent micronutrient deficiencies, particularly iron and calcium, driven by limited dietary diversity and socioeconomic disparities.

Previous studies have identified MUAC as a reliable indicator of maternal undernutrition, with cut-offs below 23 cm associated with low birth weight. Nutritional surveys in rural Maharashtra highlight low consumption of iron-rich and protein-rich foods, which exacerbates anemia and poor gestational weight gain. Evidence also demonstrates that biochemical markers such as ferritin, serum iron, and hemoglobin provide critical insights into maternal nutritional health.

However, region-specific data from Nashik remain limited. Existing studies rarely integrate anthropometric indicators with biochemical assessments in the same population sample. This study aims to bridge this gap by offering a comprehensive view of maternal nutrition in Nashik.

3. Methodology

3.1 Study Design and Population

A community-based cross-sectional study was conducted between January and July 2025 in the Nashik district. The study included **320 pregnant women** in their second and third trimesters.

3.2 Sampling Technique

A multistage sampling approach was followed:

1. Selection of three talukas from Nashik district.
2. Random selection of six primary health centers (PHCs).
3. Systematic sampling of registered pregnant women at PHCs and Anganwadis.

3.3 Inclusion and Exclusion Criteria

Inclusion:

- Pregnant women (18–40 years)
- Permanent residents of Nashik
- Willing to participate

Exclusion:

- High-risk pregnancies
- Chronic diseases affecting nutritional markers

3.4 Data Collection Tools

Dietary Intake

- Structured FFQ (Food Frequency Questionnaire)
- 24-hour dietary recall
- Dietary Diversity Score (FAO-standard 9-group DDS)

Anthropometry

- Weight, height, BMI
- MUAC (measured with non-stretchable tape)

Biochemical Assessment

Blood samples analyzed for:

- Hemoglobin (cyanmethemoglobin method)
- Serum iron
- Ferritin
- Serum calcium

3.5 Statistical Analysis

Data were analyzed using SPSS v.26. Descriptive statistics summarized nutritional indicators. Chi-square tests evaluated associations between anemia and sociodemographic factors. Logistic regression identified predictors of poor nutritional status. $p < 0.05$ was considered statistically significant.

3.6 Ethical Considerations

Ethical clearance was obtained from an Institutional Ethics Committee. Written informed consent was collected from all participants.

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4. Results

4.1 Socio-Demographic Characteristics

- Mean age: 24.7 ± 4.2 years
- 61% from low-income households
- 56% in joint families
- 72% had secondary or lower education

4.2 Anthropometric Indicators

Indicator	Mean ± SD	% Below cutoff
MUAC	22.8 ± 2.1 cm	47.5%
BMI	20.3 ± 3.4 kg/m²	39.1% underweight

4.3 Biochemical Indicators

Marker	Mean	Deficiency (%)
Hemogobin	10.2 g/dL	**62.1% anemic**
Serum Iron	48 µg/dL	42.8%
Ferritin	18 ng/mL	37.2%
Serum Calcium	8.1 mg/dL	23.1%

4.4 Dietary Intake

Food Group	% inadequate intake
Inadequate green leafy vegetable intake	68%
Low fruit consumption:	72%
Protein intake below RDA	54%
Diet Diversity Score <5	63%

4.5 Statistical Associations

Anemia is significantly associated with:

- Low socioeconomic status ($p < 0.01$)
- Low DDS ($p < 0.01$)
- Low ferritin ($p < 0.001$)
  Logistic regression showed low DDS and low ferritin as the strongest predictors.

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5. Discussion

The findings reveal a concerning prevalence of undernutrition among pregnant women in Nashik. Nearly half had MUAC values reflecting chronic energy deficiency. The **62% anemia rate** aligns with national trends but underscores that existing supplementation programs remain insufficient.

Micronutrient deficiencies, particularly low ferritin and serum iron, indicate depleted iron reserves—likely exacerbated by low dietary diversity. The high proportion of women with inadequate intake of vegetables, fruits, and proteins reflects both cultural dietary patterns and economic constraints.

The association between dietary diversity and anemia reinforces global evidence linking micronutrient intake with hemoglobin levels. Consistent with studies from Maharashtra, socioeconomic status remains a decisive determinant of maternal nutrition.

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6. Conclusion

The nutritional status of pregnant women in the Nashik region remains suboptimal, with high prevalence of anemia, iron deficiency, low dietary diversity, and anthropometric undernutrition. Integrated interventions are required to address the multidimensional nature of maternal malnutrition.

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7. Recommendations

1. Strengthen antenatal nutritional counseling on dietary diversification.
2. Enhance iron, folic acid, and calcium supplementation compliance.
3. Promote community-level nutrition awareness through Anganwadi centers.
4. Improve access to affordable protein-rich foods.
5. Regular MUAC and biochemical monitoring during ANC visits.

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8. Limitations

- Cross-sectional design does not establish causality.
- Dietary recall subject to under- or over-reporting.
- Study limited to PHC-registered women; may not represent unregistered populations.

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