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Exploring the Implementation, Delivery, and Utilization of Various Interventions Through ICDS and Schools Across Telangana and Karnataka: A Mixed Method Study

EXECUTIVE SUMMARY

BACKGROUND

Malnutrition among children in India remains a major public health concern, contributing to impaired growth, cognitive delays, and increased vulnerability to infections. While national programs such as the ICDS and MDM scheme have expanded access to food, significant gaps persist in nutrient adequacy and dietary diversity-particularly in low-resource settings. Millets, particularly finger millet (ragi), offer a culturally acceptable and nutritionally rich option for supplementation. Ragi is naturally high in calcium, iron, fiber, and several essential micronutrients, making it well-suited for use in large-scale feeding programs. To address these nutritional gaps, a fortified ragi malt powder ('Sai Sure') enriched with essential vitamins and minerals was developed. The formulation aims to deliver a substantial portion of daily micronutrient requirements, supporting the nutritional needs of both undernourished and healthy children. This study was undertaken to assess the current landscape of nutrition interventions implemented through ICDS and school-based platforms in Karnataka and Telangana. It specifically examined the delivery, utilization, and acceptability of fortified ragi malt within these systems. The findings aim to inform policy and programmatic decisions for scaling up millet-based nutrition interventions.

OBJECTIVES

The project aimed to:

- Conduct nutrient analysis for Different Finger Millet samples: Ragi grain, Premium Ragi flour, Sprouted Ragi flour, Raw Ragi malt powder;
- Assess acceptability of the fortified ragi malt among target beneficiaries.
- Evaluate sensory attributes using structured sensory evaluation protocols.
- Capture perceptions, facilitators, and barriers to implementation via in-depth interviews with key stakeholders: CDPOs, Supervisors, Anganwadi Workers, School In-charges, Parents, and Students.
- Conduct structured household interviews to understand millet consumption patterns, barriers, and enabling factors.
- Provide actionable recommendations for programme integration and scale-up.

METHODOLOGY

Study Design and Population

A mixed-methods design was adopted to comprehensively evaluate the acceptability, sensory characteristics, and contextual determinants influencing the utilization of fortified ragi malt within existing nutrition programs. The study combined laboratory analyses, field assessments, and community-based inquiries across multiple sites in Telangana and Karnataka.

Nutrient analysis was performed on four types of finger millet samples: raw grain, premium flour, sprouted flour, and raw ragi malt powder to assess proximate composition and micronutrient profiles. The field-based acceptability assessment was conducted in two randomly selected Anganwadi Centres in Hamalbasti, Tarnaka, Hyderabad, catering to preschool children (3–6 years) from low-income households.

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A laboratory-based sensory evaluation was undertaken at the ICMR-National Institute of Nutrition, Hyderabad, using a semi-trained panel of 15 research scholars. Product attributes, including appearance, aroma, texture, taste, and overall acceptability, were scored on a standardized 9-point hedonic scale under controlled conditions.

To understand implementation feasibility and community perceptions, in-depth qualitative interviews were conducted with CDPOs, supervisors, Anganwadi workers, school in-charges, parents, and students across Yadadri Bhuvanagiri and Mahbubnagar districts in Telangana, and Chikkaballapur and Raichur districts in Karnataka. These sites represented diverse rural, urban, and tribal settings. In parallel, structured household interviews were administered in the same districts to collect quantitative information on dietary practices, frequency and sources of millet consumption, barriers to use, and awareness of nutritional benefits. A total of 270 households in Telangana and 240 in Karnataka (equally from Chikkaballapur and Raichur) were surveyed.

Qualitative data were analyzed thematically using Braun and Clarke's six-phase reflexive framework, while quantitative data were summarized using descriptive statistics and mean hedonic scores to triangulate findings across methods

RESULTS

Nutrient Analysis of different finger millet samples

- Raw Ragi malt powder showed lesser protein and higher total soluble sugars compared to other samples; fat, phytic acids, tannins, and diastatic activity were nearly equal across all samples

Sensory Evaluation

- Overall high acceptability: Scores for both variants (ragi malt mixed in milk or ragi malt mixed in water were ≥8.0 across most attributes.
- Taste & aroma: Karnataka's milk-based K1 consistently outperformed Telangana's water-based T1.
- Texture: Smooth, lump-free preparations rated highest; thick or watery variations lowered scores.
- Aroma: Mildly lower in T1, linked to absence of milk fat aroma.

Acceptability Study

- Children generally consumed the full serving when preparation quality was optimal.
- Milk-based malt (used in Karnataka) was associated with better satiety and preference.
- For the ragi malt in mixed in water and jaggery, acceptability was strong but slightly reduced compared to ragi-malt mixed in milk due to preparation medium.
- Caregivers reported willingness to continue product use (ragi malt mixed in water or milk), citing perceived energy boost and health benefits.

In-depth Interviews - Key Themes

Preparation Quality

- Critical factor for acceptance; improper mixing or incorrect viscosity reduced intake.
- Serving temperature influenced consumption, particularly in younger children.

Menu Rigidity & Waste

- Fixed menus created predictable dislikes (e.g., brinjal curry), causing avoidable waste.

THR/Balamrutham

- Monotony and large pack sizes encouraged diversion to other family members; occasional misuse in non-target foods.

Supply Chain

- Egg supply irregularities, storage challenges, and infrastructure deficits in kitchens and water supply.

Human Resources

- Helper (aayah) shortages increased workload; need for refresher training noted.

Digital Reporting Burden

- Multiple platforms and paper forms strained frontline workers' time.

Community Engagement

- Parents trusted frontline staff but wanted more menu variety and inclusion of fruits/snacks.

Agriculture-Nutrition Linkages

- Karnataka: Ragi-dominant production; limited seed availability for other millets.
- Telangana: Weak market linkages; lack of assured procurement discouraged farmer participation.

Structured Household Interviews

Sample Profile

- Telangana: n=272, mean age ≈38.7 years, 97% female respondents.
- Karnataka: n=240, mean age ≈41.7 years, 94% female respondents.
- Typical household size: 4-5 members.

Millet Consumption

- **Any millet use**: Telangana 90.8%, Karnataka 100%.
- **Daily consumption**: Telangana 83.5%, Karnataka 100%.
- **Species mix**:
  - Jowar: Telangana 86.8% vs Karnataka 56.2%.
  - Ragi: Telangana 82.7% vs Karnataka 68.3%.
  - Bajra: Telangana 28.7% vs Karnataka 43.3% (38% daily in Karnataka).
  - Little, foxtail, and barnyard millets: minimal use in both states.

Sources

- Telangana: Predominantly purchased (76.5%); own-produce 14.3%.
- Karnataka: Predominantly own-produce (59.6%); purchased 40.4%.

Barriers

- Telangana: Cost (5.5%), lack of awareness (55.9% reported as barrier), availability (18.4%).
- Karnataka: Availability (19.2%) and limited diversity; negligible cost concerns.

Awareness

- Telangana: 94.9% aware of nutritional benefits.
- Karnataka: 62.5% aware.

Suggestions for Scale-Up

- Telangana: Reduce price, ensure ration shop availability, increase awareness.
- Karnataka: Increase market availability, promote awareness, diversify seeds.

CONCLUSIONS

- Strong acceptability: Both variants (ragi malt mix) well received, milk-based malt showing highest preference.
- Preparation quality: Consistency in viscosity, lump-free texture, and appropriate serving temperature are critical for ragi malt mix acceptability.
- Menu inflexibility in Schools: Contributes to waste; flexibility can enhance consumption.
- THR format at the Anganwadi centre: Large packs and monotony reduce adherence.
- Operational bottlenecks at the schools and Anganwadi centre: Include supply chain weaknesses, kitchen infrastructure, and human resource gaps.
- Market and production patterns of millets: Influence household millet consumption differently in the two states.
- Community willingness to improve nutrition interventions at schools: High engagement potential if structured feedback loops are formalized.

RECOMMENDATIONS

- **Product & Preparation**
  - Adopt milk-based preparation of ragi malt where feasible.
  - SOPs for viscosity, texture, and temperature.
  - Introduce flavour variants and age-appropriate serving sizes.
- **Extension to Anganwadi Centres**
  - Given the high compliance and strong acceptability of fortified ragi malt across users, the product can be extended to other Anganwadi Centres.
- **Impact Evaluation Before Scale-Up**
  - Before scaling to other parts of India, conduct a robust impact evaluation including cost-benefit analyses to assess nutritional outcomes, feasibility, and economic viability.
- **Menu Diversification**
  - Weekly fruit and iron-rich snack inclusion.
  - Flexibility for local substitutions.
- **THR Reform**
  - Smaller, nutrient-dense sachets with preparation instructions.
  - Introduce flavour variants to improve compliance.
- **Supply Chain & QA**
  - Strengthen egg procurement, enforce weight and quality standards.
  - Upgrade kitchen infrastructure and water facilities.
- **Human Resources & Capacity**
  - Fill helper vacancies.
  - Regular refresher trainings for cooks and AWWs with practical demonstrations.
- **Digital Reporting**
  - Streamline reporting processes, enable offline data entry.
- **Community Engagement**
  - Establish school/ICDS food committees with parental involvement.
  - Document and act on feedback.
- **Agriculture-Nutrition Convergence**
  - Telangana: Assured procurement and PDS inclusion.
  - Karnataka: Expand certified seed access, promote decentralized millet processing.

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