EVALUATING THE APPLICATION OF NEPALESE FOOD COMPOSITION DATABASE FOR ADDRESSING IRON DEFICIENCY ANEMIA

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ABSTRACT

Iron deficiency anemia (IDA) remains a persistent public health challenge in Nepal, affecting 43% of children under five and up to 47.6% of pregnant women. This study evaluates the quality and applicability of the Nepalese Food Composition Table (NFCT) and the Nepal Agricultural Research Council (NARC) database for addressing the IDA burden. Using a qualitative design, the methodology comprised 12 semi-structured Key Informant Interviews with stakeholders from government, academia, and the private sector, supplemented by a literature review and a comparative technical review against the Indian Food Composition Tables (IFCT). Results show that NFCT 2017, despite covering 387 food items, lacks analytical sensitivity, carries an estimated error margin of ±10%, and omits iron bioavailability data. NARC 2024 is more statistically structured but limited by geographic bias and a lack of animal-source and processed-food data. IFCT 2017, by contrast, shows stronger analytical precision, broader geographic coverage, and bioavailable-iron profiling. These gaps constrain dietary assessment and nutrition-sensitive policy planning in Nepal. The study recommends a multi-sectoral approach to strengthen laboratory infrastructure, adopt standardized FAO/INFOODS methodologies, and integrate food composition data digitally, supporting the Multi-Sector Nutrition Plan III and a shift from supplementation toward sustainable food-based strategies.

1. INTRODUCTION

Iron deficiency anemia (IDA) in Nepal

Micronutrient deficiencies, especially IDA, continue to be a persistent public health problem in Nepal, affecting cognitive development in children and adolescents and physiological health in women of reproductive age. Despite decades of targeted interventions, the burden of anemia in Nepal remains among the highest in the South Asian region. The 2022 Nepal Demographic and Health Survey (NDHS) reports a national prevalence of 43% among children under five and 46% to 47.6% among pregnant women (MoHP, 2023). Iron deficiency is thought to account for roughly half of all anemia cases (Sherpa et al., 2026). High anemia prevalence reflects both low intake of iron-rich foods and poor iron utilization by the body.

Food composition database (FCD)

FCDs are the building blocks of nutrition science; they are used to measure food consumption and translate it into nutrient intake. Globally, organizations such as FAO/INFOODS have made significant efforts to harmonize, standardize, and improve access to this data (Charrondiere et al., 2020; Ortenzi et al., 2021). Nevertheless, gaps remain in food composition data, particularly regarding the relevance and usefulness of such data for developing-country contexts.

FCD in nutrition planning

FCDs play a critical role in nutrition planning and program decision-making. High-quality, standardized databases enable accurate nutrient intake estimates and help identify population-level deficiencies for targeted interventions (Ahuja et al., 2020; Charrondiere et al., 2022). However, the limited coverage of micronutrients in these databases constrains the development of effective nutrition strategies (Beal et al., 2021). Improved data quality and harmonization strengthen dietary assessment accuracy, which is essential for sound policymaking, while the inclusion of indigenous biodiversity in datasets makes strategies more culturally relevant and better suited to local dietary needs (Stadlmayr et al., 2020).

FCD in research and nutrition programs

FCD is central to nutritional epidemiology as the analytical tool that converts food consumption data into nutrient profiles for population-level health assessments. High-quality FCD is essential for translating findings into effective micronutrient programs; weak FCD coverage of iron and vitamin A constrains program design in developing countries (Charrondiere et al., 2022). Differences in analytical methods and documentation across studies also make findings difficult to compare and less reliable (González-Domínguez et al., 2021; Ortenzi et al., 2021).

FCD in dietary guidelines

FCD is critical for converting nutrient goals into dietary recommendations and remains a vital tool for public health interventions. Gaps in this data reduce the accuracy of intake measurement and weaken the evidence base for dietary recommendations (Micha et al., 2021). Global studies emphasize harmonized, high-quality FCD as a prerequisite for effective, evidence-based food and nutrition guidelines (Charrondiere et al., 2022), and evidence supports incorporating indigenous foods to improve dietary adequacy modelling and cultural relevance (Stadlmayr et al., 2020).

Dietary assessment tools and FCD

Combining FCDs with dietary assessment instruments such as food frequency questionnaires, 24-hour recalls, and digital applications is central to modern nutritional epidemiology. Digital tools have improved the efficiency and accessibility of dietary assessment, but FCD quality remains the key determinant of accuracy (Cade et al., 2021; Kirkpatrick et al., 2020). Newer tools, including mobile and image-based systems, depend on real-time access to comprehensive FCDs to calculate nutrient intake (Illner et al., 2021). Cross-platform integration remains challenging, however, due to inconsistent food classification and a lack of standardized food descriptors (Westenbrink et al., 2021), and limited food matching reduces accuracy across different dietary contexts (Bradley et al., 2020).

Data quality evaluation for FCD

FCD is reliable only when established quality criteria, particularly those recommended by FAO/INFOODS, are followed. Key criteria include sampling representativeness, validated analytical methods, sound nutrient profiles, and complete metadata documentation (Charrondiere, 2020). Where these are inconsistent, data quality and comparability suffer (Ortenzi et al., 2021), limiting the usefulness of FCDs for research and policy applications (Greenfield & Southgate, 2021; Kumari et al., 2023). Poor analytical validation can also introduce errors in nutrient values, particularly for micronutrients (Beal et al., 2021).

This study assessed the quality of iron-content data in Nepal's food composition tables and the NARC database in relation to the national IDA burden. Specifically, it evaluated the comprehensiveness, methodological quality, and contextual relevance of existing food composition data; identified gaps in micronutrient profiling; and explored how existing data could inform nutrition policy, dietary assessment, and nutrition-based interventions. A comparative technical review of the Nepalese and Indian food composition tables was conducted using secondary data.

2. METHODOLOGY

This study used a qualitative research design combined with a literature review. Primary qualitative data were collected through 12 semi-structured Key Informant Interviews (KIIs) with stakeholders from government, academia, development partners, and the private sector, focusing on institutional roles in IDA prevention and management and on programmatic opportunities for applying FCD. A review of nutrition policy documents identified gaps and opportunities for FCD application in IDA prevention and management in Nepal. Findings were validated through expert consultation with nutrition and food composition specialists.

3. RESULTS AND DISCUSSION

Food composition database of Nepal

Systematic FCD collection in Nepal began more than six decades ago with the establishment of the Department of Food in 1961, which later evolved into the Department of Food Technology and Quality Control (DFTQC) (DFTQC, 2017; Ojha et al., 2024). Over time, Nepal's food composition tables have improved, strengthening their role in nutritional research, dietary assessment, and policy formulation. The Nepalese Food Composition Table (NFCT) 2017 is the country's most extensive national table, covering 387 food items across major food groups, including a substantial number of plant-based iron sources. Its nutrient profile includes proximate composition, three minerals (iron, calcium, and phosphorus), and four vitamins (carotene, vitamin C, riboflavin, thiamin, and niacin) (DFTQC, 2017).

NFCT 2017 follows a product-based approach and uses standardized AOAC laboratory protocols, but its analytical methods lack sensitivity, producing less precise micronutrient values. This yields an estimated error margin of ±10% when sampling from local markets, compounded by environmental variability, which limits confidence in nutrient estimates. The table also lacks data on iron bioavailability. Figure 1 shows the distribution of food items across the eight NFCT groups.

The recently launched NARC FCD 2024 represents a shift toward a more structured, statistically grounded approach. It covers 100 food products using structured sampling and standardized AOAC and ASTM protocols (Ojha et al., 2024), but its scope remains narrow: it focuses primarily on plant foods, omits animal-source and processed foods, and is further limited by geographic sampling bias across over- and under-sampled regions.

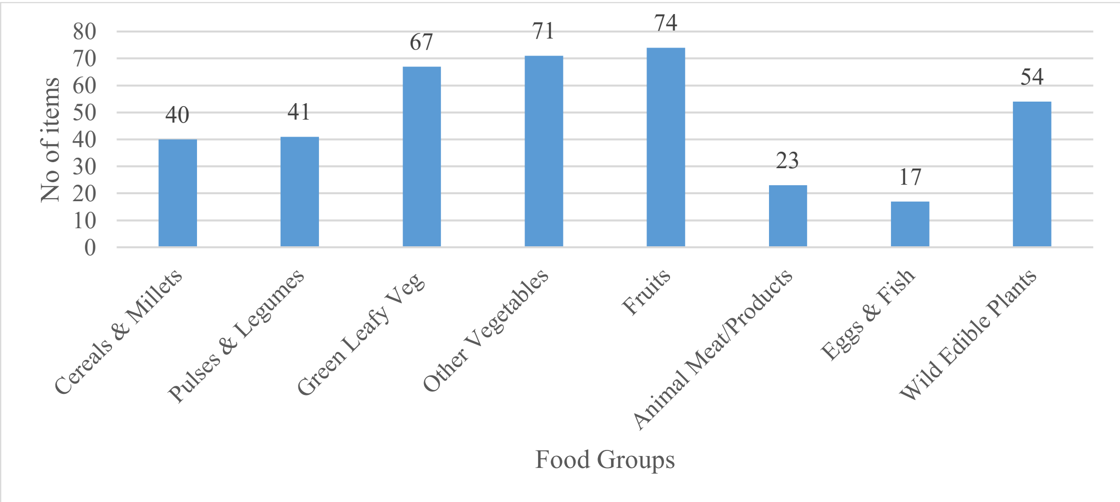

Figure 1. Coverage of food items in NFCT 2017.

By comparison, the Indian Food Composition Tables (IFCT) 2017 represent a well-established system developed since 1937 and updated over subsequent decades (Longvah et al., 2017). IFCT 2017 covers 533 food items across 20 plant- and animal-based food groups, supporting more comprehensive assessment of both total and bioavailable iron intake. Figure 2 shows the distribution of food items across the thirteen IFCT groups.

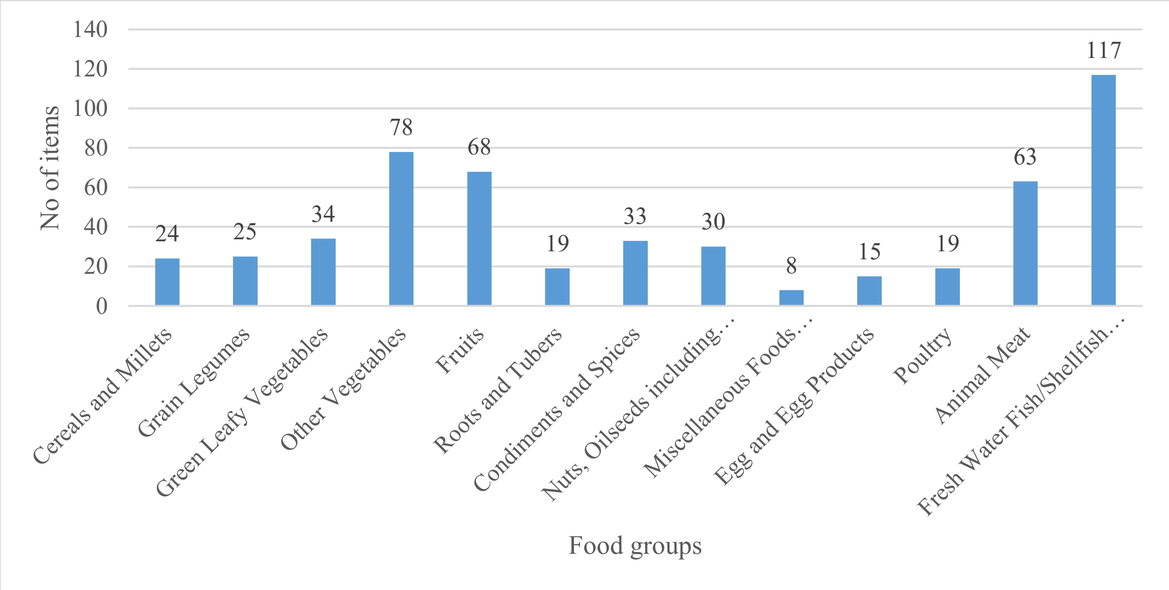

Figure 2. Coverage of food items in IFCT 2017.

Both countries show strong coverage of plant foods, reflecting national dietary patterns dominated by cereals, legumes, and green leafy vegetables. India's IFCT, however, has substantially stronger representation of animal-source foods, allowing better estimation of bioavailable iron intake than Nepal's database. India also shows clear superiority in analytical precision and consistency: its use of certified reference materials and probability-based sampling produces more reliable, comparable data (Longvah et al., 2017), whereas Nepal's limited laboratory capacity yields less accurate and less reproducible results, reflecting underlying differences in technical infrastructure and investment. Geographic representativeness is another key gap: IFCT draws on nationally representative sampling across diverse agro-ecological zones, while Nepal's datasets carry regional bias, particularly under-representing remote and ecologically distinct areas, which limits their usefulness for national-level dietary evaluation and policymaking. Both countries also share difficulty in measuring iron bioavailability, a gap that limits understanding of the physiological significance of nutrient composition data.

Both systems struggle to capture the full diversity of indigenous foods, ethnic dishes, and processed foods, though Nepal's gaps are deeper, particularly in indigenous biodiversity and micronutrient completeness. Both databases point to the need for food-based solutions that support traditional, nutrient-dense food crops; underutilized foods are recognized as potential iron sources in both countries, labelled as pseudocereals in Nepal and as millets in India.

Utilization of FCD in IDA prevention

In Nepal, DFTQC, under the Ministry of Agriculture and Livestock Development, leads FCD development and management. KII findings point to multiple opportunities for applying FCD within ongoing nutrition programs across ministries, development partners, and professional sectors, particularly in promoting locally available foods as a sustainable, food-based strategy for anemia prevention. However, inadequate data on iron-rich foods continues to constrain program planning and policy use, directly limiting the design of effective Social and Behavioral Change (SBC) programs for IDA prevention.

Weak FCD coverage limits efforts to promote dietary diversity locally, restricts the integration of indigenous and iron-rich foods into programs, and weakens evidence-based dietary counseling. It also reduces the effectiveness of nutrition labelling, limits promotion of iron-rich foods within Food-Based Dietary Guidelines (FBDGs), and weakens SBC approaches targeting IDA prevention. Table 1 summarizes KII findings on institutional roles and programmatic opportunities for using FCD in IDA prevention.

Table 1: Institutional role and strategic opportunities for utilizing FCD in IDA prevention

S.N.	Agency	Role (in IDA Prevention and Management)	Opportunities
1	National Planning Commission	Coordinates national nutrition programs across federal, provincial, and local levels	Promote programs encouraging consumption of iron-rich foods
2	Ministry of Agriculture and Livestock Development	Plans and implements nutrition-sensitive agriculture; develops food balance sheets; develops and promotes FBDGs	Strengthen nutrition-sensitive agriculture planning; promotes food-based strategies focused on iron nutrition; address iron in FBDGs
3	Ministry of Health and Population	Distributes Iron-Folic Acid (IFA) supplements to adolescents and pregnant women; implements school health programs	Promote dietary diversity with iron-rich foods; supports development of iron-rich school meal recipes; enables gradual transition from supplementation to food-based approaches
4	Ministry of Education, Science and Technology	Designs school curricula; implements school meal programs	Integrate iron-rich food concepts into curricula; incorporate iron-rich foods in school meals
5	Ministry of Federal Affairs and General Administration	Plan and implement nutrition programs at provincial and local levels	Support design and dissemination of SBC messages
6	Provincial Ministries (Agriculture, Health)	Plan agriculture and nutrition-specific programs	Promote nutrition-sensitive agriculture; integrates SBC messages into health education
7	Local Governments	Implements agriculture and health programs at local level	Strengthen delivery of effective SBC programs
8	Academia (Universities)	Designs and updates curricula; conducts research and development	Incorporate food composition data into academic curricula
9	Food Industries	Nutrition labelling for consumer education	Enhance consumer education through labelling; develop iron-rich processed foods; promote indigenous iron-rich foods in niche markets
10	Hospitals (Clinicians and Dietitians)	Dietary recommendations	Educate vulnerable groups, including children, adolescents, and pregnant women
11	Development Partners (e.g., World Food Programme, UNICEF)	Support food fortification; manages severe and moderate acute malnutrition	Food-based program planning; promote dietary diversity across health and agriculture SBC programs

S.N.	Agency	Role (in IDA Prevention and Management)	Opportunities
		(SAM, MAM); promotes nutrition-sensitive agriculture	
12	Consumer Associations	Deliver SBC messages to the general public	Promote consumption of iron-rich foods; discourage unnecessary iron supplementation

Note. IDA = Iron Deficiency Anemia; IFA = Iron-Folic Acid; SBC = Social and Behavior Change; FBDGs = Food-Based Dietary Guidelines; SAM = Severe Acute Malnutrition; MAM = Moderate Acute Malnutrition.

4. CONCLUSION

Nepal's food and nutrition literacy lags significantly, driven by an incomplete Food Composition Database (FCD) that covers basic nutrients for less than half of commonly consumed foods. Crucial data on traditional foods, anti-nutritional factors, and plant-iron bioavailability remain unrecorded—a major gap given Nepal's predominantly plant-based diet.While recent initiatives like NARC 2024 mark progress, DFTQC still faces severe analytical and coverage constraints. To modernize Nepal's FCD system, a coordinated multi-sectoral approach is required;

Standardization & Digital Integration: Conduct primary nutrient testing via FAO/INFOODS standards and digitize FCD data for seamless use in dietary assessment tools.

Institutional Capacity: Build partnerships with universities, upgrade laboratory infrastructure, and establish continuous updating mechanisms.

Policy Alignment: Integrate updated FCD data directly into national health strategies, specifically supporting Nepal's Multi-Sector Nutrition Plan III (2023–2030) target to reduce anemia among women and children by 10%.

Strengthening FCD shifts technical data into a practical asset for evidence-based dietary guidelines and national nutrition policy.

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