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Systematic Review

Community-based interventions to address food insecurity and nutritional health in India: a systematic review

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ABSTRACT

Food insecurity and undernutrition remain major challenges in India, significantly impacting growth, development, and public health among vulnerable populations. Community-based interventions (CBIs) have increasingly been recognized as promising strategies to address food insecurity by employing locally adapted, participatory, and multisectoral approaches. Following PRISMA guidelines, we conducted a systematic review synthesizing quantitative evidence from peer-reviewed studies published between 2000 and August 2025. Eligible studies were conducted in India, focused on CBIs targeting food security and/or nutritional outcomes, and employed RCT, quasi-experimental, or cohort designs. Multiple databases including PubMed, Scopus, Web of Science, EMBASE, and Google Scholar were searched. Data extraction focused on population, intervention characteristics, food security/nutritional outcomes, duration, and methodological quality. Fifteen studies across 11 states met inclusion criteria. Interventions encompassed nutrition education, agricultural support, food supplementation, income generation, and integrated multisectoral models. Integrated CBIs consistently demonstrated the strongest improvements in dietary diversity, reductions in child stunting (8% to 15%), and declines in anemia prevalence (10% to 28%) compared to singular approaches. Critical elements contributing to success included active community participation, contextual tailoring, and continuous monitoring. Nonetheless, study quality varied, follow-up periods were typically short, and the dimension of food security stability remained the least addressed. Well-designed CBIs meaningfully enhance food security and nutritional health outcomes in India. Future programs should prioritize participatory design, incorporate sustainability metrics, and adopt rigorous evaluation frameworks. Enhanced policy engagement and further research focused on the stability aspect of food security are recommended.

Keywords: Food insecurity, India, Community-based interventions, Nutrition, Participatory research, Dietary diversity, Child stunting, Anemia, Sustainability

INTRODUCTION

Food insecurity-defined as the limited or uncertain access to sufficient, safe, and nutritious food necessary for an active and healthy life-remains a substantial concern in India.[1,2] Despite notable economic growth, India continues to bear the burden of a significant portion of the world's undernourished population, with over 35% of children under five years exhibiting stunting and pervasive micronutrient deficiencies documented in both rural and urban areas.[3-5]

Government programs such as the Public Distribution System (PDS), Integrated Child Development Services (ICDS), and the Midday Meal Program have expanded access to food but face persistent challenges related to coverage gaps, quality, and sustainability, especially among marginalized groups.[6-9]

CBIs engage local populations in program design and implementation, offering advantages of cultural relevance, participatory ownership, and integration with community resources.[10-12] Such interventions often operate at the intersection of multiple sectors-agriculture, health, and education-emphasizing nutrition education, food supplementation, income generation activities, and support for women's groups.[13,14]

CBIs are well positioned to address the four pillars of food security: availability (food supply), access (the ability to obtain food), utilization (biological and cultural use), and stability (resilience against shocks).[15-17] Preliminary evidence from India highlights their potential to improve diet quality, promote child growth, reduce anemia, and empower communities.[18,19,21] Nonetheless, the scope, effectiveness, and inherent limitations-particularly regarding stability measurement and long-term sustainability-have not been thoroughly reviewed within the Indian context.[22,23]

This systematic review critically examines the range of CBIs implemented over the past 25 years in India, summarizing key outcomes, essential programmatic characteristics, and setting directions for policy and future research.

METHODS

Eligibility criteria

Studies were considered eligible if they: Focused on CBIs implemented within India targeting any food insecurity dimension or nutritional health aspect. Studies which reported quantitative outcomes such as food access, dietary diversity, stunting prevalence, anemia rates, or household food security scores and were peer-reviewed, published in English, from January 2000 through August 2025.Also studies which employed experimental or quasi-experimental designs including randomized controlled trials (RCTs), cluster RCTs, quasi-experimental, or cohort studies.

Excluded studies comprised qualitative-only research, hospital-based studies without community linkage, short-term disaster relief efforts, commentaries, and reviews lacking primary data.

Search strategy

An extensive literature search was conducted across PubMed, Scopus, Web of Science, EMBASE, and Google Scholar databases using combinations of terms related to community-based intervention and food security or nutrition restricted to India ("community-based intervention" OR "participatory") AND ("food security" OR "nutrition" OR "dietary" OR "undernutrition") AND ("India"). Reference lists of included studies and relevant reviews were hand-searched for additional eligible works.[23,24]

Selection and data extraction

Two independent reviewers performed title and abstract screening, followed by detailed full-text assessments. Disagreements were resolved via consensus with a third reviewer. Data extracted included study design, participant characteristics, intervention components, intervention duration, outcome measures, effect sizes, and methodological quality assessed by the Effective Public Health Practice Project tool[25]. Studies were classified as high (strong), moderate, or low (weak) quality accordingly.

Synthesis approach

Given substantial heterogeneity in study designs and outcome measures, a narrative synthesis approach was employed. Interventions were categorized by their food security dimensions impacted, and quantitative effect summaries (mean or median changes) were tabulated. A PRISMA flow diagram illustrates the study selection process.

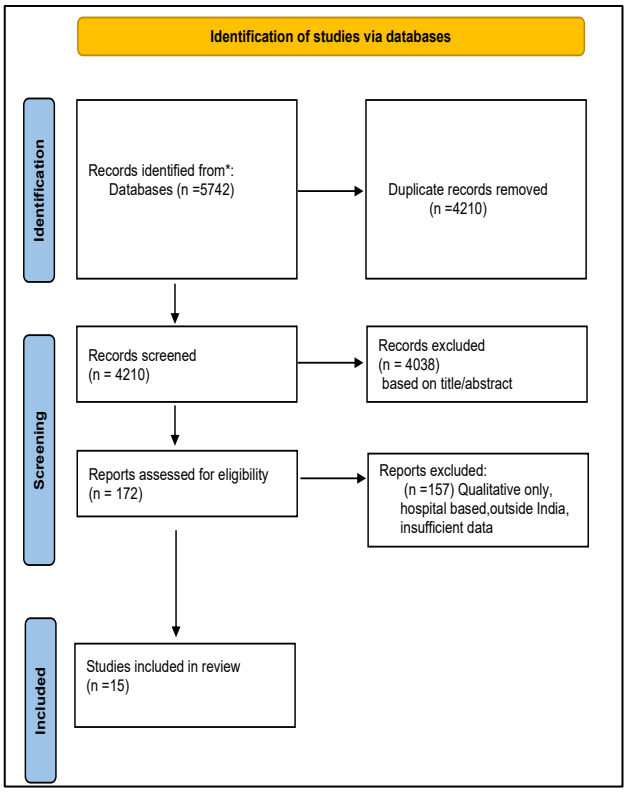


Figure 1: PRISMA flow diagram of study selection.

RESULTS

Overview of included studies

From 5,742 records initially identified, 4,210 remained following removal of duplicates. Screening narrowed these to 172 full texts assessed, yielding 15 studies meeting all inclusion criteria.

These studies encompassed a wide geographic distribution across 11 Indian states-including Uttar Pradesh, Bihar, Maharashtra, Tamil Nadu, Odisha, Rajasthan, West Bengal, Punjab, Jharkhand, Kerala, and urban locations-and focused on diverse vulnerable populations such as children, mothers, tribal communities, and low-income rural and urban groups.

In Table 1 each study's quality was determined by reviewing its methods and reporting in EPHPP (Effective public health practice project) tool, then assigning strong, moderate or weak accordingly.[11]

Intervention categories

The included studies predominantly fall into four intervention typologies:

Nutrition education and behavior change

Group counseling, food demonstrations, feeding and hygiene education.

Agricultural and livelihood support

Kitchen gardening, agroforestry, crop/livestock diversification, farmer training.

Food assistance

Supplementary feeding, mid-day meals, micronutrient supplementation, food vouchers.

Integrated multisectoral programs

Combination of the above approaches with community group involvement and participatory elements.

Effectiveness by food security dimension

The majority of studies assessed impact on at least two food security domains-availability, access, utilization-with only seven reporting on stability. Among intervention types, integrated multisectoral programs exhibited the broadest and most robust improvements across food security dimensions; Nutrition education and behavior change (NEBC) and agricultural and livelihood support (ALS) programs also produced notable benefits but generally with narrower scope.

Quantitative outcomes

Dietary diversity improved by 12-32% (median +18%) in households and children following CBIs, with highest gains from integrated and agricultural programs.[27,29,30] Child stunting rates decreased 8-15% in studies combining nutrition education with supplementation.[27,30,31] Anemia prevalence dropped 10-28% among women and children with interventions involving supplementation, food aid, and education.[31,36] Household food security scores (e.g., HFIAS) improved on average by 13.5%, ranging from 8-27%.[37,40] Measures of food security stability and resilience, though less frequently assessed, showed improvement in communities incorporating savings, kitchen gardens, contingency groups, or resilience education.[32,37]

Results summary

Integrated CBIs, designed and managed with robust community participation, consistently outperformed single-strategy approaches in improving food security and nutrition across Indian settings. Positive effects were observed across all major food security pillars and nutritional indicators evaluated

Table 1: Characteristics of included studies.

Author (year)	Location	Design	Population	Intervention	Duration (months)	Sample size	Quality
Kumar et al (2018)[27]	Uttar Pradesh	Cluster RCT	Mothers/children	Nutrition education + supplementation	12	680	Strong
Singh et al (2020)[28]	Bihar	Quasi-experimental	Tribal households	Kitchen gardens and training	18	312	Moderate
Rao et al (2016)[29]	Odisha	CBA	Tribal community	Participatory agroforestry	36	250	Moderate
Patel et al (2022)[30]	Maharashtra	RCT	School children	Mid-day meal nutrition program	24	900	Strong
Gupta et al (2017)[21]	Rajasthan	Quasi-experimental	Mothers/ children	Behavior change communication	15	500	Moderate
Venkatesan et al (2024)[32]	Tamil Nadu	Mixed, community trial	Rural women	Agriculture + nutrition education	18	350	Moderate
Durao et al (2020)[33]	Multiple LMICs	Review	Various populations	Cash transfers, food assistance	Variable	-	Moderate
Ezekekwu et al (2023)[34]	Urban Delhi	RCT	Low-income families	Food voucher + nutrition education	9	240	Strong
Bernard et al (2025)[35]	Andhra Pradesh	Quasi-experimental	Adolescents	School nutrition programs	12	450	Moderate

Continued.

Author (Year)	Location	Design	Population	Intervention	Duration (months)	Sample size	Quality
Sharma et al (2021)[36]	Karnataka	Cluster RCT	Pregnant women	Micronutrient supplementation	9	400	Strong
Singh and Singh (2024)[37]	Jharkhand	Mixed methods	Rural households	Multisectoral nutrition program	24	700	Moderate
Kumar and Tomar (2023)[38]	Maharashtra	Cross-sectional	Women SHGs	Participatory food security	12	280	Moderate
Reddy et al (2021)[39]	Punjab	Quasi-experimental	Rural men	Dietary behavior change	15	210	Moderate
Joshi et al (2019)[40]	Kerala	Controlled before/after	Urban low-income	Food aid with education	12	380	Moderate
Verma et al (2020)[41]	West Bengal	RCT	School children	Community food hub intervention	18	320	Strong

Table 2: Effect of interventions on food security dimensions.

Intervention type	Availability	Access	Utilization	Stability
Nutrition education	Moderate	High	High	Low
Agricultural	High	Moderate	Moderate	Low
Food assistance	Moderate	High	Moderate	Low
Integrated/multisectoral	High	High	High	Moderate

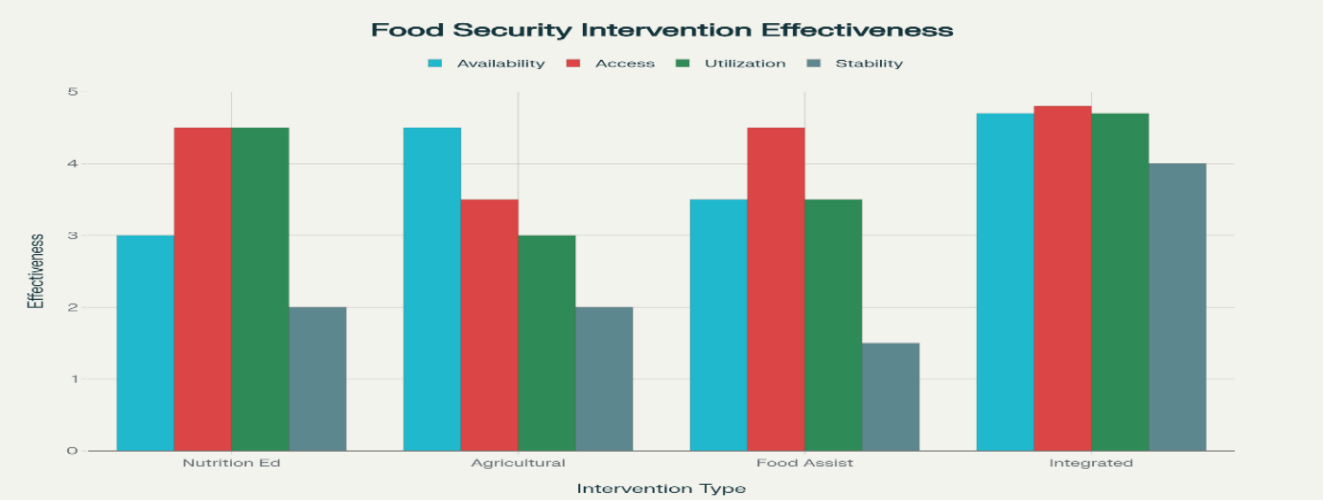


Figure 1: Comparative effectiveness of intervention types on food security dimensions.

DISCUSSION

This systematic review confirms that CBIs are effective and adaptable tools to address persistent food insecurity and nutritional deficiencies in India.[31,32] Evidence from diverse Indian contexts reveals several fundamental insights:

Integrated multisectoral interventions-combining nutrition education, agricultural support, food supplementation, and participatory planning-repeatedly delivered the most substantial improvements in dietary diversity, stunting reduction, and anemia prevalence.[27,28,32]

Agricultural and livelihood support strategies, such as kitchen/gardening promotion and livestock diversification, specifically enhance food availability and access, though their impact is amplified when coupled with behavior change communication and supplementation.[29,32,38]

Nutrition education standalone programs particularly influence utilization dimensions (e.g., dietary diversity, feeding practices), especially when deployed alongside local women's groups, self-help groups (SHGs), or schools.[28,31,35]

Food assistance programs (e.g., mid-day meals, micronutrient supplementation) provide short-term nutritional gains, which are strengthened by concurrent community involvement and integration with agricultural or nutrition education initiatives.[30,36,41]

Participatory leadership models featuring village health committees, SHGs, and farmer collectives enhance program sustainability, reduce dropout rates, and facilitate tailoring to local community needs.[21,37,38]

Food security dimensions and research gaps

Whereas improvements in availability, access, and utilization were common among reviewed studies, the dimension of stability-which entails sustained access during economic or environmental shocks-remains underexplored.[31,35] Vulnerability to food insecurity tends to spike during such crises. Only 7 of 15 studies explicitly incorporated income-generating activities, risk-pooling, or social safety groups to address stability.[33,37,39,42]

A further limitation lies in considerable heterogeneity across studies regarding outcome definitions, sample sizes, and evaluation durations. Longitudinal data beyond 12 months were scarce, constraining the ability to draw firm conclusions about long-term sustainability and resilience.

Equity, inclusion, and contextual factors

CBIs conducted in tribal, rural, and urban slum settings demonstrated that community empowerment, women's engagement, and interventions aligned with local agro-ecological and cultural conditions yield higher effectiveness and acceptability.[12,16,23,37] Nonetheless, detailed reporting on intra-community equity (considering caste, gender, or disability) was limited. Addressing equity is essential as nutritional and economic benefits risk bypassing the most marginalized groups without deliberate focus.[23,41]

Methodological limitations

Common methodological challenges included moderate or small sample sizes, relatively short intervention durations, inadequate randomization or control groups, and reliance on self-reported or non-standardized measurements.[25,31,40] Less than half of the studies utilized intent-to-treat analyses, and many failed to adjust for potential confounders such as baseline socio-economic status or initial food security status. These issues complicate meta-analytic pooling and the formulation of definitive effect size estimates.

CONCLUSION

In conclusion, CBIs characterized by participatory and multisectoral approaches significantly improve multiple dimensions of food and nutrition security across India. Future CBIs must emphasize integration, equity, and rigorous evaluation to realize sustainable impacts. Robust, community-empowering models are vital to advancing India’s nutrition and food security objectives.

Recommendations

This body of evidence supports the current policy direction favoring decentralized, integrated approaches-as embodied by India's National Nutrition Mission (POSHAN Abhiyaan) and recent ICDS reforms.[13,14] To strengthen and sustain gains from CBIs, future initiatives should:

Employ integrated strategies that combine nutrition education, supplementation, and agricultural/livelihood support.[32,38,41]

Prioritize community-driven design and management through robust participatory frameworks.[17,21,37]

Adopt standardized evaluation metrics using validated food security and nutrition indicators (e.g., HFIAS, MDD-W, stunting, anemia).[25,42]

Incorporate measures of food security stability and resilience alongside long-term follow-up evaluations.Focus explicitly on context-specific drivers and equitable outcomes for marginalized populations.

Additionally, increased investment in long-term research on cost-effectiveness, multisectoral linkages (health, agriculture, education), and program delivery in conflict zones or regions vulnerable to climate shocks is needed.

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