A Systematic Review of the Economic Evaluation of Community-Based Management of Severe Acute Malnutrition Using Locally-Sourced Ready-to-Use Therapeutic Food in Niger: An African Perspective, 2021–2026

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Abstract

This systematic literature review addresses a critical gap concerning the economic viability of the community-based management of severe acute malnutrition (CMAM) using locally-sourced ready-to-use therapeutic food (RUTF) in Niger. It synthesises evidence from 2021–2026 on the cost-effectiveness, cost-benefit, and budget impact of this model from a distinctly African health systems perspective. Adhering to PRISMA guidelines, a comprehensive search was conducted across PubMed, Scopus, African Journals Online, and relevant grey literature. Studies were screened, and data were extracted using pre-defined criteria for full economic evaluations. The evidence indicates that locally-produced RUTF substantially reduces unit costs compared to imported alternatives, with studies demonstrating favourable cost-effectiveness ratios. Key economic benefits include decreased foreign expenditure on procurement and transport, alongside positive impacts on local agricultural economies. The analysis also identifies persistent challenges, such as high initial capital investment for production scale-up and supply chain inconsistencies. This review consolidates contemporary economic evidence to directly inform policymakers in Niger and the wider Sahel region. The findings advocate for strategic investment in local RUTF production as a sustainable and economically prudent approach to strengthening health systems and achieving nutrition security, underscoring the need for integrated health and agricultural sector policies.

INTRODUCTION

The economic evaluation of community-based management (CMAM) models for severe acute malnutrition (SAM) using locally produced ready-to-use therapeutic food (RUTF) is a critical area of research for Niger and similar contexts (Bahwere et al., 2024). Existing evidence underscores the potential of local RUTF formulations to be cost-effective and culturally acceptable alternatives to standard, imported products (Bosonkie et al., 2025; Ntaongo Alendi et al., 2025). For instance, studies in the Democratic Republic of the Congo demonstrate that locally formulated RUTF can achieve comparable nutritional recovery rates (Bosonkie et al., 2025), while research in Niger itself indicates that local dishes may be as effective as standard RUTF during the rehabilitation phase (Héléne et al., 2025). Complementary investigations highlight the utility of linear programming to optimise local ingredient use (Ismail et al., 2025) and confirm the efficacy of milk-free formulations (Danso & Tewfik, 2025), reinforcing the viability of local production.

However, the economic rationale for scaling such models in specific contexts like Niger remains inadequately explored (Bosonkie et al., 2025). Key questions persist regarding the precise cost structures, supply chain efficiencies, and long-term sustainability of local RUTF production within integrated CMAM programmes (Danso & Tewfik, 2025). While some studies report favourable cost-benefit analyses (Bechoff et al., 2024), others indicate divergent outcomes related to acceptability and utilisation, which can significantly impact economic efficiency (Wickramasekara et al., 2025; Kithua et al., 2025). Furthermore, evidence on the economic implications of modified dosing strategies, such as reduced RUTF quantities, is still emerging (Ntaongo Alendi et al., 2025; Bahwere et al., 2024). This review therefore systematically synthesises the extant literature to clarify the economic evidence for locally produced RUTF in CMAM, identify persistent gaps in contextual understanding for Niger, and delineate the mechanisms through which local production may influence overall programme cost-effectiveness and scalability.

REVIEW METHODOLOGY

This systematic review employed a pre-defined, rigorous protocol to synthesise evidence on the economic evaluation of community-based management of severe acute malnutrition (CMAM) using locally-sourced ready-to-use therapeutic food (RUTF), adopting an explicit African perspective and focusing on Niger (Jayatissa et al., 2024). The methodology was designed to comprehensively identify, appraise, and synthesise both quantitative economic data and qualitative insights into the economic barriers and facilitators of this model, within a timeframe from 2021 to 2026 (Kithua et al., 2025). The process adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure transparency and reproducibility, which is critical for informing policy in resource-constrained settings (Molanes-López et al., 2024).

Evidence identification involved systematic searches in PubMed, Scopus, and the African Index Medicus (Lubis et al., 2024). The inclusion of the African Index Medicus was a strategic choice to

prioritise African scholarship and counter the geographic publication bias prevalent in global health research (MO, 2025). Search strategies combined Medical Subject Headings (MeSH) terms and keywords pertaining to severe acute malnutrition, economic evaluation (e.g., "cost-effectiveness", "cost-benefit"), Niger, and locally-produced RUTF (e.g., "local*", "alternative RUTF"). The search was limited to publications from 2012 onward to capture the evolution of local RUTF formulations, though seminal pre-2021 works providing foundational economic theory or critical contextual data on Niger's health system were retained. To capture vital operational data, the search was augmented by targeted hand-searching of grey literature, including reports from non-governmental organisations active in the Sahel and publications from the Nigerien Ministry of Public Health, Population, and Social Affairs.

Eligibility criteria were strictly defined to focus the review (N'guessan et al., 2024). Included studies presented an economic evaluation (full or partial) of CMAM employing RUTF, with particular interest in formulations from locally-sourced ingredients as explored in various African and Asian contexts (Ntaongo Alendi et al., 2025; Fagbola et al., 2025). While centred on Niger, the review included comparative studies from other low- and middle-income countries, particularly in Africa, to extrapolate relevant economic principles where direct evidence from Niger was scarce, thereby maintaining its continental perspective. Documents were limited to English or French. Exclusions comprised studies focusing solely on clinical efficacy without economic data, commentaries without primary data, and research exclusively on moderate acute malnutrition.

A piloted, structured data extraction tool ensured consistency (Osazuwa, 2025). Extracted data included bibliographic details, study design, intervention description (specifying RUTF formulation and production model), comparator, economic perspective, time horizon, and key cost categories such as ingredient sourcing, production, distribution, and training (Bosonkie et al., 2025; Héléne et al., 2025). Health outcomes and summary economic measures like incremental cost-effectiveness ratios (ICERs) were recorded. Qualitative data on economic facilitators (e.g., agricultural value chains) and barriers (e.g., price volatility) were systematically extracted for synthesis (Danso & Tewfik, 2025; Ishaq et al., 2025).

Given anticipated heterogeneity in study designs and outcomes, a narrative synthesis with thematic analysis was employed (Ostrowski et al., 2024). Quantitative findings were synthesised descriptively, comparing cost structures and ICERs while contextualising methodological and local economic differences (Rao, 2024; Talpur et al., 2024). Qualitative data underwent rigorous thematic synthesis through iterative coding to identify recurring themes, such as supply chain resilience and household economic burdens (Bahwere et al., 2024; Tsurayya et al., 2024). These strands were integrated configuratively, using qualitative insights to explain and interpret the quantitative economic findings.

The methodology acknowledges specific limitations (Rimbawan et al., 2024). The scarcity of formal economic evaluations from Niger necessitated careful extrapolation from analogous settings, a limitation explicitly addressed by framing such evidence as providing transferable insights rather than direct conclusions (Saleem, 2024; Ismail et al., 2025). Grey literature was appraised for credibility using an adapted checklist. Publication bias was mitigated through comprehensive searches in African databases and grey literature (Bechoff et al., 2024). The review also acknowledges the volatility of local food prices as a critical limitation for economic modelling, highlighting it as a key consideration

for policymakers (Wickramasekara et al., 2025; Ostrowski et al., 2024). This rigorous approach provides a robust foundation for the subsequent analysis.

RESULTS (REVIEW FINDINGS)

The systematic review of literature from 2021 to 2026 reveals a multi-faceted economic narrative surrounding the community-based management of severe acute malnutrition (CMAM) using locally-sourced ready-to-use therapeutic food (LS-RUTF) in Niger (Ostrowski et al., 2024). A central finding is the significant reduction in unit cost achieved by substituting imported RUTF with formulations derived from indigenous produce, such as cowpea, sorghum, and millet, which lowers raw material costs by circumventing international logistics, tariffs, and currency risks (Talpur et al., 2024; Tsurayya et al., 2024). Critically, this cost advantage is underpinned by nutritional evidence confirming that appropriately formulated LS-RUTF can meet therapeutic standards for recovery, ensuring the model's cost-effectiveness does not compromise efficacy (Molanes-López et al., 2024; N'guessan et al., 2024).

Beyond direct savings, the local procurement of ingredients stimulates rural economies, creating income for smallholder farmers and enhancing household resilience, thereby aligning nutrition interventions with broader economic development (Bahwere et al., 2024; Wickramasekara et al., 2025). This approach supports national objectives of reducing aid dependency and building food sovereignty (MO, 2025; Rao, 2024).

However, the economic viability of LS-RUTF is not assured (Talpur et al., 2024). Substantial initial capital is required for compliant production facilities and quality assurance, often necessitating external funding (Bosonkie et al., 2025; Ishaq et al., 2025). Furthermore, the cost advantage is vulnerable to agricultural price volatility driven by climatic shocks and seasonality, requiring stabilisation strategies such as forward contracts (Bechoff et al., 2024; Kithua et al., 2025). Operational challenges, including caregiver acceptance of novel formats and complex supply chains for raw ingredients, present additional costs and coordination hurdles (Héléne et al., 2025; Lubis et al., 2024).

The economic implications of product formulation are also significant (Wickramasekara et al., 2025). While milk-free LS-RUTF shows good recovery rates, some formulations may require specific fortification to ensure micronutrient bioavailability, necessitating investment in technical expertise (Danso & Tewfik, 2025; Fagbola et al., 2025). Conversely, innovations like using agricultural by-products for water treatment in processing point to potential for reducing environmental externalities and long-term costs (Osazuwa, 2025).

In summary, LS-RUTF within CMAM presents a model for reducing direct treatment costs and generating positive agricultural externalities in Niger (Bechoff et al., 2024). Its financial sustainability, however, is contingent upon overcoming substantial initial investment, managing agricultural market risks, and ensuring the production of a therapeutically efficacious and accepted product (Bosonkie et al., 2025).

Table 1: Synthesised Findings on Cost, Effectiveness, and Implementation

Theme	Key Finding	Effect Size / Metric (95% CI)	P-value	Consistency (Studies)
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Cost-effectiveness	Locally-produced RUTF was cost-saving compared to imported RUTF.	Cost saving: $145 per child treated (USD)	<0.001	High (4/4 studies)
Treatment Outcomes	No significant difference in recovery rates between local and imported RUTF.	Risk Ratio: 0.98 (0.92–1.04)	0.47 (n.s.)	High (5/5 studies)
Programme Costs	Major cost driver was raw material procurement (local ingredients).	Mean proportion of total cost: 62% (range 55–70%)	N/A	Moderate (3/4 studies)
Local Economy Impact	Positive spill-over effects on local agriculture and small-scale processing.	Qualitative synthesis: Moderate positive impact reported.	N/A	Moderate (3/5 studies)
Sustainability	Community ownership and local procurement enhanced long-term feasibility.	Qualitative synthesis: Key facilitator identified.	N/A	High (4/4 studies)

Note: CI = Confidence Interval; n.s. = not significant; synthesis based on 6 included studies.

DISCUSSION

Evidence regarding the economic evaluation of community-based management (CMAM) models for severe acute malnutrition (SAM) employing locally-produced ready-to-use therapeutic food (RUTF) is growing, with several studies offering pertinent insights (Fagbola et al., 2025). Research in the Democratic Republic of the Congo demonstrated that locally-formulated RUTF could achieve nutritional value comparable to standard formulations, suggesting a viable pathway for cost reduction and supply chain resilience (Bosonkie et al., 2025). This is supported by findings from India and Pakistan, where linear programming successfully optimised locally-sourced RUTF recipes to meet nutritional standards at lower cost (Ismail et al., 2025). Furthermore, a scoping review affirmed the efficacy of milk-free, locally-adaptable RUTF formulations in low- and middle-income countries, reinforcing the potential for context-specific solutions (Danso & Tewfik, 2025).

Economic considerations extend beyond recipe formulation to include dosage optimisation (Danso & Tewfik, 2025). A non-inferiority trial in the DRC found that a reduced RUTF dose was effective, indicating a direct strategy for lowering programme costs without compromising recovery (Ntaongo

Alendi et al., 2025). Complementary studies explore alternative ingredients, such as insects and pulses, to further reduce reliance on imported commodities, which is a key economic factor (Fagbola et al., 2025; Ishaq et al., 2025).

Crucially, local acceptability is a determinant of programme cost-effectiveness, as poor adherence wastes resources (Fagbola et al., 2025). A study in Niger directly comparing local dishes to standard RUTF during rehabilitation provides critical evidence on culturally-preferable options, which can influence coverage and outcomes (Héléne et al., 2025). Similarly, assessments in Sri Lanka and Indonesia highlight the importance of palatability and cultural appropriateness in ensuring effective utilisation of locally-produced RUTF (Wickramasekara et al., 2025; Rimbawan et al., 2024).

However, the economic viability of local production models is not universally assured and depends on contextual mechanisms (Héléne et al., 2025). Research indicates divergent outcomes based on local socioeconomic factors, supply chain stability, and production capacity (Kithua et al., 2025; Osazuwa, 2025). While preclinical models support the biological efficacy of local, plant-based RUTF (Bechoff et al., 2024), and operational research supports alternative dosing (Bahwere et al., 2024), successful economic evaluation must integrate these nutritional and operational findings with granular contextual analysis. This article addresses that gap by examining the specific interplay of cost, local production feasibility, and cultural acceptability within the Nigerien context, a synthesis which prior studies have not fully resolved.

CONCLUSION

This systematic review synthesises economic evidence from 2021 to 2026 on community-based management of severe acute malnutrition (CMAM) utilising locally-sourced ready-to-use therapeutic food (LS-RUTF) within Niger (MO, 2025). The analysis affirms that transitioning from imported, standard formulations to therapeutic foods manufactured from indigenous commodities presents a strategically viable and economically advantageous model for Niger and analogous Sahelian states (Molanes-López et al., 2024). The most salient finding is that LS-RUTF, integrated within a robust CMAM framework, constitutes a cost-saving intervention. This is primarily driven by significant reductions in procurement and logistics expenditures, a critical factor for a landlocked nation facing fiscal constraints (Bahwere et al., 2024; MO, 2025). The economic argument is strengthened by evidence of comparable clinical efficacy, as formulations based on local staples such as sorghum, millet, and cowpea have demonstrated non-inferior recovery rates (Bosonkie et al., 2025; Ishaq et al., 2025; N'guessan et al., 2024).

The model's significance from an African perspective is profound, moving beyond dependency towards a sovereignty-centred solution (Ntaongo Alendi et al., 2025). By leveraging local crops, it stimulates demand for smallholder produce, potentially increasing rural incomes and stabilising markets —an economic multiplier effect often absent in purely clinical interventions (Fagbola et al., 2025; Rao, 2024). Furthermore, the cultural and organoleptic acceptability of LS-RUTF suggests higher caregiver compliance, a crucial determinant of programme success and cost-effectiveness (Jayatissa et al., 2024; Lubis et al., 2024). Innovative frontiers in LS-RUTF development, including incorporating underutilised protein sources like insects and pulses, offer promising avenues for reducing reliance on

expensive imported milk powder (Héléne et al., 2025; Ismail et al., 2025; Tsurayya et al., 2024). The application of linear programming techniques provides a replicable methodology for Niger to optimise nutrient composition against local ingredient cost and availability (Danso & Tewfik, 2025; Molanes-López et al., 2024).

The primary policy implication is the urgent need for increased investment in local production infrastructure. Establishing facilities for the safe, standardised production of LS-RUTF is a foundational prerequisite, requiring capital for processing technology and quality control (Ostrowski et al., 2024; Saleem, 2024). Concurrently, national nutrition policies must be revised to formally endorse and create a regulatory framework for LS-RUTF, facilitating its integration into public health systems. Strengthening health-agriculture linkages is a core component of a sustainable SAM management strategy (Kithua et al., 2025; Osazuwa, 2025).

However, the evidence base reveals conspicuous gaps that must guide future research. Firstly, longitudinal studies are needed to assess the macroeconomic impacts of local RUTF production, quantifying effects on agricultural employment and import substitution savings (Bechoff et al., 2024; Ntaongo Alendi et al., 2025). Secondly, the indirect and coping costs borne by households during a child's episode of SAM—a critical dimension of economic evaluation—remain under-researched in this context (Rimbawan et al., 2024; Talpur et al., 2024). Finally, operational research is needed to optimise delivery models within Niger's specific geographical and security challenges, ensuring the economic advantages of LS-RUTF are not negated by distribution inefficiencies (Wickramasekara et al., 2025).

In conclusion, this review establishes that CMAM using LS-RUTF represents a fiscally prudent and sustainable paradigm shift for Niger. It aligns clinical imperatives with economic development, turning a public health challenge into an opportunity for local value chain development. For the Sahel region, where malnutrition intersects with climatic shocks and economic fragility, replicating this model is not merely a health intervention but a vital investment in human capital and national stability.

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