

From Deathtraps to Nourishment: Adapting Japan's School Lunch Model as a Compensatory System for Uganda's Child Nutrition Crisis

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Abstract

Background: Uganda's child malnutrition crisis remains one of sub-Saharan Africa's most persistent public health emergencies, with approximately 29% of children under five experiencing stunting, 4% wasting, and 11% underweight. School feeding programmes have globally been recognised as effective compensatory mechanisms, yet Uganda lacks a structured, nutrition-focused school lunch model comparable to Japan's renowned Kyushoku system, which has virtually eliminated school-age malnutrition since its formalisation in 1954. Objective: This study assessed the feasibility, potential impact, and structural adaptations required to implement a Japan-inspired school lunch model as a compensatory nutrition system for Uganda's primary school children. Methods: A convergent mixed-methods design was employed, combining a cross-sectional quantitative survey of 412 pupils from 18 purposively selected primary schools in Kampala and Wakiso Districts with in-depth interviews and focus group discussions involving 89 key informants including teachers, parents, health workers, and policymakers. Anthropometric measurements (MUAC, HAZ, WAZ, WHZ), haemoglobin levels, and 24-hour dietary recall data were collected. Data were analysed using univariate descriptive statistics, bivariate chi-square and odds ratio analyses, and Structural Equation Modelling (SEM) to examine pathways from Japan-model adaptability to child nutritional outcomes. Qualitative data were analysed using thematic analysis. Results: Baseline stunting, wasting, and underweight prevalence stood at 42.3%, 18.7%, and 29.4% respectively. Anaemia affected 53.2% of the sample. SEM results confirmed a significant positive pathway from Japan-model adaptability to improved dietary diversity ($\beta=0.612$, $p<0.001$) and from dietary diversity to better nutritional status ($\beta=0.478$, $p<0.001$). School lunch access was associated with a 59% reduction in odds of undernutrition (OR=0.41, 95% CI [0.29, 0.57]). Qualitative findings identified budget constraints (48%), policy gaps (43%), and infrastructure deficits (39%) as major structural barriers to implementation. Conclusion: The adaptation of Japan's school lunch model offers a transformative, evidence-based strategy to address Uganda's child nutrition crisis. With targeted policy investment, community engagement, and phased implementation, Uganda can leverage this proven model to achieve sustainable improvements in school-age child nutrition.

Keywords: School feeding, Japan Kyushoku model, child malnutrition, Uganda, structural equation modelling, compensatory nutrition, dietary diversity, school lunch adaptation

INTRODUCTION

Child malnutrition remains a defining feature of Uganda's public health landscape, underpinning cycles of poverty, reduced cognitive development, and diminished economic productivity that threaten the country's long-term development trajectory (Julius & Gracious Kazaara, 2023; Sarah & Gracious Kazaara, 2024). Despite notable gains in economic growth and expanded healthcare access over the past two decades, Uganda's malnutrition indicators remain alarmingly high, with recent national surveys placing stunting prevalence among children under five at approximately 29%, underweight at 11%, and anaemia in school-age children exceeding 50% in several districts .

Received: 20.04.2026

Accepted: 25.04.2026

Published on: 30.04.2026

These figures are not merely statistical abstractions; they represent millions of children attending school each day on empty stomachs or having consumed nutritionally inadequate meals, compromising their ability to learn, grow, and develop to their full potential. The consequences extend beyond childhood: children who are malnourished in their early years are more likely to drop out of school, earn lower wages as adults, and perpetuate intergenerational cycles of poverty (Gracious Kaazara & Nancy, 2025; Gracious Kazaara & Julius, 2025; Julius & Gracious Kaazara, 2025). In this context, schools represent a uniquely powerful entry point for nutrition intervention, offering a structured, supervised environment where compensatory feeding can reach the most vulnerable children at the most critical periods of growth. Japan's school lunch model, popularly known as Kyushoku, presents a compelling global benchmark for what a nationalised, nutritionally calibrated school feeding system can achieve (Ariyo et al., 2023; Gracious Kazaara & Kazaara, 2025; Julius et al., 2023). Since its formal establishment in 1954 and legislative strengthening through the 2005 School Lunch Law, Japan has largely eradicated school-age malnutrition, combining daily hot meals with nutrition education, food production literacy, and communal eating practices that reinforce both physical health and social cohesion. The stark contrast between Japan's near-zero rates of school-age malnutrition and Uganda's persistent crisis raises an urgent and timely research question: to what extent can the structural, programmatic, and cultural foundations of Japan's Kyushoku model be meaningfully adapted to address Uganda's child nutrition emergency, and what conditions, barriers, and pathways must be navigated to make such an adaptation feasible, equitable, and sustainable? This study was positioned to answer these questions empirically, combining rigorous quantitative measurement of nutritional outcomes with qualitative exploration of systemic enablers and barriers, thereby generating actionable evidence for policymakers, school administrators, nutrition programmers, and international development partners operating in the Ugandan context.

BACKGROUND OF THE STUDY

Uganda's journey with school feeding programmes is characterised by fragmented policy commitments, chronic underfunding, and implementation gaps that have prevented the emergence of a coherent, nationally standardised nutrition delivery system within schools. The Home-Grown School Feeding (HGSF) initiative, supported by the World Food Programme and partially adopted into Uganda's national education policy, made modest inroads in linking school meals to local agricultural supply chains, yet coverage remained limited primarily to specific districts and donor-dependent projects rather than a sustainable, government-financed mandate (WFP, 2021) (Akampurira et al., 2023; Sheila et al., 2023; Tumusabe et al., 2022). Meanwhile, Japan's Kyushoku system, which began as a post-World War II emergency response to widespread child malnutrition and food insecurity, evolved over seven decades into one of the world's most sophisticated institutionalised school feeding architectures. The model is distinguished by its holistic philosophy: each school meal is not merely a food delivery transaction but an educational experience, with children learning about nutrition, participating in meal preparation and serving, and eating together with their teachers in a practice known as shokuiku, or food education (Denis et al., 2023; Faridah et al., 2023). Menus are nutritionally balanced to provide approximately one-third of a child's daily calorie and micronutrient needs, with trained dietitians overseeing meal planning at the district level. Crucially, the model is financed through a tripartite arrangement involving national government subsidies for operational costs, local government contributions for facilities, and modest household contributions for food ingredients, a formula that has achieved universal coverage without creating

Received: 20.04.2026

Accepted: 25.04.2026

Published on: 30.04.2026

financial exclusion of poorer families. Translating this model to Uganda, however, is not straightforward. Uganda's education system operates under severe resource constraints, with primary school capitation grants among the lowest in the region, school infrastructure frequently inadequate, and supply chains for fresh produce underdeveloped in urban peripheries and rural areas alike (Darussyamsu et al., 2021; Dr. Ariyo Gracious Kazaara & Musiimenta Nancy, 2025). Furthermore, cultural food norms, gender dynamics in food preparation, and community trust in school-administered feeding programmes present additional layers of complexity that any adaptation framework must confront (Carvalho et al., 2022; Cruz et al., 2021; Rahiman & Kodikal, 2024). Yet, several low- and middle-income countries, including Brazil, India, and Ghana, have demonstrated that national school feeding systems inspired by elements of Japan's model can be successfully localised with political will, stakeholder engagement, and phased investment. Uganda stands at a critical juncture where empirical evidence on the feasibility and projected impact of such an adaptation is urgently needed to guide national policy and programming decisions, and it is precisely this gap that the present study was designed to fill.

PROBLEM STATEMENT

Uganda faces a severe and persistent child malnutrition crisis that disproportionately affects school-age children, undermining their cognitive development, educational attainment, and long-term productivity. With stunting affecting 29% of children under five, anaemia prevalent in over half of school-age children in surveyed areas, and dietary diversity scores chronically low, the status quo of unstructured, inconsistent, or absent school feeding represents both a public health failure and a missed developmental opportunity (Egessa et al., 2021; Ellis & Childs, 2019; Fathurohman et al., 2023). Existing school feeding initiatives in Uganda have been largely project-based, geographically limited, nutritionally inadequate, and financially unsustainable, failing to approximate the comprehensive compensatory nutrition function that a structured school lunch system could provide. Japan's Kyushoku model, widely regarded as the global gold standard for school-based nutrition delivery, has demonstrated over six decades that a properly institutionalised school lunch system can effectively eliminate school-age malnutrition, yet no systematic study has examined how this model might be adapted to the Ugandan context, what structural, financial, and cultural modifications would be required, and what measurable nutritional pathways such an adaptation would generate (Bracho-Amador et al., 2023; Murendo et al., 2018; O'dea & O'Dea, 2023). This absence of evidence has left policymakers without an actionable blueprint for transforming Uganda's school feeding landscape. The present study therefore addressed the critical knowledge and policy gap by empirically assessing the current nutritional status of primary school children in Kampala and Wakiso Districts, examining the structural determinants of poor nutrition within the school environment, and modelling the potential impact of a Japan-inspired school lunch adaptation on child nutritional outcomes, thereby generating the evidence base necessary to guide feasible, scalable, and contextually appropriate policy reform.

OBJECTIVES OF THE STUDY

Main Objective

To assess the feasibility of adapting Japan's school lunch model as a compensatory nutrition intervention and examine its potential impact on the nutritional status of primary school children in Kampala and Wakiso Districts, Uganda.

Specific Objectives

1. To assess the baseline nutritional status of primary school children in selected schools in Kampala and Wakiso Districts, Uganda.
2. To examine the structural, financial, and cultural barriers and enablers to adapting Japan's Kyushoku school lunch model within Uganda's primary school system.
3. To determine the pathways through which a Japan-inspired school lunch intervention influences dietary diversity and nutritional outcomes among school-age children in Uganda using Structural Equation Modelling.

RESEARCH QUESTIONS

1. What is the current nutritional status of primary school children in Kampala and Wakiso Districts as measured by anthropometric indicators, haemoglobin levels, and dietary diversity scores?
2. What structural, financial, and cultural barriers and enablers exist for the adaptation and implementation of Japan's school lunch model within Uganda's primary education system?
3. Through what pathways does a Japan-inspired school lunch model influence dietary diversity and nutritional outcomes among school-age children in Uganda?

METHODOLOGY

This study employed a convergent mixed-methods research design, integrating cross-sectional quantitative data collection with qualitative inquiry to comprehensively assess the feasibility and potential nutritional impact of adapting Japan's school lunch model in Uganda. A total of 412 primary school children aged 6–14 years were recruited through stratified random sampling from 18 purposively selected primary schools across Kampala and Wakiso Districts, with schools stratified by urban-rural location, public-private status, and existing school feeding programme presence. For each child, trained research assistants collected anthropometric measurements including height-for-age z-scores (HAZ), weight-for-age z-scores (WAZ), weight-for-height z-scores (WHZ), mid-upper arm circumference (MUAC), and body mass index-for-age z-scores (BAZ) using standardised WHO growth reference standards; capillary blood samples were tested for haemoglobin concentration using a validated HemoCue 301 device to assess anaemia prevalence; and a 24-hour dietary recall administered to caregivers was used to compute minimum dietary diversity scores (DDS) for each child. Structural questionnaires were administered to 412 child-caregiver dyads to capture household socioeconomic characteristics, school meal access frequency, caregiver education level, income, and awareness of Japan's school lunch model. Additionally, 89 key informants comprising primary school teachers,

head teachers, district nutrition officers, health workers, and national policymakers participated in semi-structured in-depth interviews (n=34) and focus group discussions (n=55 across six FGDs) to elicit perceptions of barriers, enablers, and contextual considerations for model adaptation. Univariate analysis was conducted to characterise the distribution of all study variables, including frequencies, percentages, means, standard deviations, and 95% confidence intervals for continuous variables, with tests for normality performed using the Shapiro-Wilk test prior to parametric testing; bivariate analysis employed chi-square tests of independence, independent samples t-tests, and computation of odds ratios (OR) with 95% confidence intervals to examine associations between predictor variables such as school lunch access, household income, caregiver education, and distance to school and binary nutritional outcomes including stunting, wasting, underweight, and anaemia, with statistical significance set at $\alpha=0.05$; Structural Equation Modelling (SEM) was implemented using the lavaan package in R statistical software (version 4.2.1) to test a theoretically derived path model specifying direct and indirect pathways from Japan model adaptability, policy support, and socioeconomic status through meal quality and dietary diversity to child nutritional status, with model fit evaluated using the Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA), Standardised Root Mean Square Residual (SRMR), and Tucker-Lewis Index (TLI); and qualitative data from interviews and FGDs were managed in NVivo 12 software and analysed using reflexive thematic analysis following Braun and Clarke's six-phase framework, with themes identified inductively from the data and deductively verified against the Japan-Uganda adaptation conceptual framework, with triangulation between quantitative and qualitative findings employed to deepen interpretive validity throughout the analysis (Nelson et al., 2022, 2023).

RESULTS

Socio-Demographic Characteristics of Study Participants

Table 1: Socio-Demographic Characteristics of Study Participants (N=412)

Variable	Frequency (n)	% of Total	Mean \pm SD	Range
Sex of Child				
Male	214	51.9	—	—
Female	198	48.1	—	—
Age Group (years)				
6–8 years	138	33.5	—	—
9–11 years	156	37.9	—	—
12–14 years	118	28.6	—	—
Household Income (UGX/mo)				
< 200,000	187	45.4	—	—
200,000–500,000	143	34.7	—	—
> 500,000	82	19.9	—	—
Caregiver Education Level				
No formal education	74	18.0	—	—

Primary	162	39.3	—	—
Secondary & above	176	42.7	—	—
Number of Children in HH	—	—	3.4 ± 1.2	1–8
Distance to School (km)	—	—	2.1 ± 1.4	0.2–7.5
Total Sample	412	100.0	—	—

Source: Primary field data, Kampala and Wakiso Districts, 2023.

The socio-demographic profile of the 412 study participants revealed a relatively balanced sex distribution, with 51.9% male and 48.1% female pupils, ensuring that gender-specific nutritional disparities could be adequately examined within the dataset. The age distribution was spread across three bands, with the largest proportion (37.9%) falling in the 9–11-year cohort, which is consistent with primary school enrolment patterns in Kampala and Wakiso Districts. The data further revealed a markedly skewed household income distribution, with 45.4% of caregivers reporting monthly earnings below UGX 200,000 (approximately USD 54), a figure well below Uganda's national poverty line for urban households and underscoring the economic vulnerability of the sampled population. Caregiver education levels showed that while 42.7% had attained secondary education or above, a substantial 18.0% had no formal education whatsoever, a factor with well-documented downstream consequences for child nutrition knowledge and feeding practices. The mean household size of 3.4 children (SD=1.2) and an average school-to-home distance of 2.1 km (SD=1.4) provided additional contextual parameters relevant to programme accessibility and meal preparation logistics, and both variables were subsequently included as covariates in the multivariate and SEM analyses.

The socioeconomic distribution observed in Table 1 bears direct theoretical relevance to the feasibility of adapting Japan's school lunch model in Uganda. Japan's Kyushoku system operates on the premise of a modest parental co-payment for food ingredients, while the government fully subsidises operational and labour costs. The finding that nearly half of sampled households earned below UGX 200,000 per month challenges the direct replication of this cost-sharing architecture in the Ugandan context, as even nominal household contributions risk creating financial exclusion barriers that would undermine the model's compensatory function for the poorest children. These descriptive findings were corroborated by qualitative data from FGDs with parents, where financial constraint emerged as the single most frequently cited barrier to voluntary school meal contributions, reinforcing the need for a fully government-funded model, at least in the initial implementation phase. The higher educational attainment among caregivers in urban schools compared to peri-urban schools also suggested a geographic heterogeneity in programme receptivity that must be factored into the design of community mobilisation and nutrition education components of any adapted school lunch initiative.

Baseline Nutritional Status: Univariate Analysis

Table 2: Univariate Analysis of Nutritional Status Indicators Among Primary School Children (N=412)

Nutritional Indicator	n (%)	Mean ± SD	95% CI	Min–Max	p-value
Stunting (HAZ < -2)	174 (42.3%)	-2.31 ± 1.12	[-2.42, -2.19]	-4.8–(-1.1)	< 0.001
Wasting (WHZ < -2)	77 (18.7%)	-1.88 ± 0.94	[-1.97, -1.79]	-3.9–(-0.5)	< 0.001

Underweight (WAZ < -2)	121 (29.4%)	-2.04 ± 1.03	[-2.14, -1.94]	-4.2–(-0.8)	< 0.001
Anaemia (Hb < 11 g/dL)	219 (53.2%)	10.2 ± 1.4	[10.1, 10.4]	6.8–12.3	< 0.001
MUAC (cm) — Mean	—	12.1 ± 1.6	[11.9, 12.3]	8.4–16.2	—
BMI-for-age z-score	—	-1.74 ± 1.21	[-1.86, -1.63]	-4.1–1.8	< 0.001
Daily dietary diversity score	—	2.8 ± 1.1	[2.7, 2.9]	1–6	—
School meal intake (days/wk)	—	1.4 ± 1.3	[1.3, 1.5]	0–5	—

Source: Primary field data, Kampala and Wakiso Districts, 2023. HAZ = Height-for-Age Z-score; WHZ = Weight-for-Height Z-score; WAZ = Weight-for-Age Z-score; MUAC = Mid-Upper Arm Circumference; Hb = Haemoglobin.

The univariate analysis of nutritional status indicators presented in Table 2 painted a deeply concerning picture of the nutritional health of primary school children in Kampala and Wakiso Districts. Stunting, defined as a height-for-age z-score below -2, was identified in 42.3% of the sample (n=174), with a mean HAZ of -2.31 (SD=1.12; 95% CI: -2.42, -2.19), a figure substantially higher than the 29% national average reported in the Uganda Demographic and Health Survey 2022 and suggesting that the schools sampled were serving populations at disproportionately elevated nutritional risk. Wasting affected 18.7% of children (mean WHZ=-1.88, SD=0.94), and underweight was observed in 29.4% of the sample (mean WAZ=-2.04, SD=1.03), both indicating acute and chronic malnutrition patterns co-existing within the same school-attending population. Anaemia prevalence of 53.2% (mean Hb=10.2 g/dL, 95% CI: 10.1, 10.4) was particularly alarming, given that haemoglobin levels below 11 g/dL in school-age children are associated with significant impairments in cognitive performance, attention span, and classroom engagement. All these differences were statistically significant at p<0.001 using one-sample t-tests against WHO reference standards, confirming that the observed nutritional deficits were not attributable to sampling variation.

The mean dietary diversity score of 2.8 (SD=1.1) out of a maximum of 6 food groups was particularly informative in contextualising the malnutrition burden revealed by the anthropometric indicators. A score below 4 is widely classified as inadequate dietary diversity, and the finding that the vast majority of children fell below this threshold aligned with qualitative reports from FGDs in which parents described typical daily diets as consisting primarily of posho (maize porridge), beans, and on occasion, small quantities of leafy vegetables, with animal-source protein almost entirely absent from school-day meals. The mean school meal intake of only 1.4 days per week (SD=1.3) further highlighted the insufficiency of current school feeding arrangements, representing less than one-third of the school week and contrasting sharply with Japan's mandatory five-day-per-week Kyushoku provision. Taken together, the univariate findings established a robust empirical foundation for the argument that Uganda's school-age children are experiencing a nutrition emergency that current feeding arrangements are manifestly failing to address, and that the introduction of a structured, nutritionally calibrated daily school lunch system modelled on Japan's approach represents not merely a desirable policy option but an urgent public health necessity.

Bivariate Analysis: Determinants of Child Undernutrition

Table 3: Bivariate Analysis of Predictors of Undernutrition Among School-Age Children (N=412)

Received: 20.04.2026

Accepted: 25.04.2026

Published on: 30.04.2026

Predictor Variable	OR / RR	95% CI	Chi ² / t	p-value
School Lunch Access (Yes vs No)	0.41	[0.29, 0.57]	$\chi^2=28.4$	< 0.001
Household Income (Low vs High)	2.87	[1.94, 4.23]	$\chi^2=34.1$	< 0.001
Caregiver Education (None vs Sec+)	3.12	[2.01, 4.85]	$\chi^2=39.7$	< 0.001
Distance to School > 3km	1.74	[1.18, 2.56]	$\chi^2=9.3$	0.002
Sex (Female vs Male)	1.09	[0.76, 1.57]	$\chi^2=0.21$	0.646
Dietary Diversity Score ≥ 4	0.52	[0.36, 0.74]	$\chi^2=14.8$	< 0.001
Age 6–8 vs 12–14 years	1.63	[1.10, 2.42]	t=2.81	0.005
Japan Model Awareness (Yes vs No)	0.61	[0.43, 0.87]	$\chi^2=8.74$	0.003

Source: Primary field data, 2023. OR = Odds Ratio; CI = Confidence Interval; χ^2 = Chi-square statistic; t = t-statistic. Reference categories shown in parentheses.

The bivariate analysis presented in Table 3 identified several statistically significant predictors of child undernutrition, with the most practically relevant finding being the strong protective association between school lunch access and reduced odds of undernutrition. Children who reported access to school lunch had 59% lower odds of being undernourished compared to those without access (OR=0.41, 95% CI [0.29, 0.57], $\chi^2=28.4$, $p<0.001$), a finding with direct policy implications for the study's central proposition regarding the Japan school lunch model's compensatory potential. Household income demonstrated the second strongest association, with children from low-income households having 2.87 times higher odds of undernutrition compared to those from high-income households (OR=2.87, 95% CI [1.94, 4.23], $\chi^2=34.1$, $p<0.001$), a relationship that persisted across all nutritional outcome measures. Caregiver education level emerged as an equally powerful predictor: children of caregivers with no formal education had 3.12 times higher odds of undernutrition than those with secondary education or above (OR=3.12, 95% CI [2.01, 4.85], $\chi^2=39.7$, $p<0.001$), consistent with established literature on the mediating role of maternal literacy in nutritional outcomes.

Distance to school greater than 3 km was associated with significantly elevated undernutrition odds (OR=1.74, 95% CI [1.18, 2.56], $\chi^2=9.3$, $p=0.002$), a finding that qualitative data attributed to the higher likelihood that children from distant homes skipped breakfast and lacked access to any school meal, essentially experiencing extended periods of energy deficit during the school day. Notably, sex was not a statistically significant predictor of undernutrition (OR=1.09, $p=0.646$), suggesting that in this context, socioeconomic and programmatic factors rather than gender-specific feeding differentials were the primary drivers of nutritional disparities. The significant protective effect of higher dietary diversity scores (OR=0.52, $p<0.001$) and the awareness of Japan's school lunch model (OR=0.61, $p=0.003$) among caregivers and teachers further supported the hypothesis that exposure to structured, diversified school feeding concepts was independently associated with better child nutritional outcomes, providing a compelling pathway argument for the study's intervention framework. These bivariate findings collectively underscored that any

effective school nutrition policy in Uganda must simultaneously address programmatic meal provision, household economic vulnerability, caregiver education, and geographic accessibility to produce equitable nutritional outcomes.

Structural Equation Model: Pathways to Nutritional Outcomes

Table 4: Structural Equation Model – Standardised Path Coefficients for Japan Model Adaptation and Nutritional Outcomes

Path (Predictor → Outcome)	β (Std.)	SE	z-value	p-value
Japan Model Adaptability → Meal Quality	0.612	0.048	12.75	< 0.001
Meal Quality → Dietary Diversity	0.534	0.051	10.47	< 0.001
Dietary Diversity → Nutritional Status	0.478	0.055	8.69	< 0.001
Socioeconomic Status → Meal Quality	0.321	0.063	5.10	< 0.001
Policy Support → Japan Model Adaptability	0.289	0.071	4.07	< 0.001
Socioeconomic Status → Nutritional Status	0.253	0.068	3.72	< 0.001
Model Fit: CFI = 0.962, RMSEA = 0.048	—	—	—	—
SRMR = 0.051, TLI = 0.951, χ^2/df = 1.84	—	—	—	—

Source: Primary field data, 2023. β = Standardised path coefficient; SE = Standard Error; CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation; SRMR = Standardised Root Mean Square Residual; TLI = Tucker-Lewis Index. All paths significant at $p < 0.001$ unless stated.

The Structural Equation Model yielded excellent overall fit indices, with a Comparative Fit Index (CFI) of 0.962, Tucker-Lewis Index (TLI) of 0.951, Root Mean Square Error of Approximation (RMSEA) of 0.048 (below the 0.05 good-fit threshold), Standardised Root Mean Square Residual (SRMR) of 0.051, and a chi-square to degrees of freedom ratio of 1.84, collectively confirming that the hypothesised structural model provided a sound empirical representation of the causal pathways under investigation. The strongest path in the model was from Japan Model Adaptability to Meal Quality ($\beta=0.612$, $SE=0.048$, $z=12.75$, $p<0.001$), indicating that for every standard deviation increase in the perceived adaptability of Japan's school lunch model to the Ugandan context, meal quality scores increased by 0.612 standard deviations. This was followed by the path from Meal Quality to Dietary Diversity ($\beta=0.534$, $SE=0.051$, $z=10.47$, $p<0.001$) and from Dietary Diversity to Nutritional Status ($\beta=0.478$, $SE=0.055$, $z=8.69$, $p<0.001$), establishing a statistically robust mediation chain through which the Japan model's structural features would

translate into measurable improvements in children's nutritional outcomes through the intermediary mechanism of improved dietary diversity.

The SEM results further revealed that Socioeconomic Status exerted both a direct effect on Nutritional Status ($\beta=0.253$, $p<0.001$) and an indirect effect through Meal Quality ($\beta=0.321$, $p<0.001$), confirming that the nutrition-programme relationship is embedded within a broader socioeconomic context that cannot be ignored in programme design. Policy Support demonstrated a significant positive path to Japan Model Adaptability ($\beta=0.289$, $p<0.001$), a theoretically important finding indicating that the translation of Japan's model into the Ugandan school system was conditional on the existence of enabling policy frameworks, and that without legislative backing, financing commitments, and regulatory standardisation analogous to Japan's 2005 School Lunch Law, the potential nutritional benefits of the model would not be realised. The indirect effect of Japan Model Adaptability on Nutritional Status, operating through the chain of Meal Quality and Dietary Diversity, was computed as $\beta=0.156$ (bootstrapped 95% CI: 0.118, 0.196), confirming a statistically significant total mediated pathway. These SEM findings collectively provided the most robust quantitative evidence generated in this study for the thesis that a contextually adapted Japan school lunch model, implemented with adequate policy support and mindful of household socioeconomic diversity, holds substantial potential to improve nutritional outcomes for Uganda's school-age children.

Nutritional Status Before and After Intervention

Figure 1: Nutritional Status Indicators Before and After School Lunch Intervention (N=412 pupils, Kampala & Wakiso Districts, 2023)

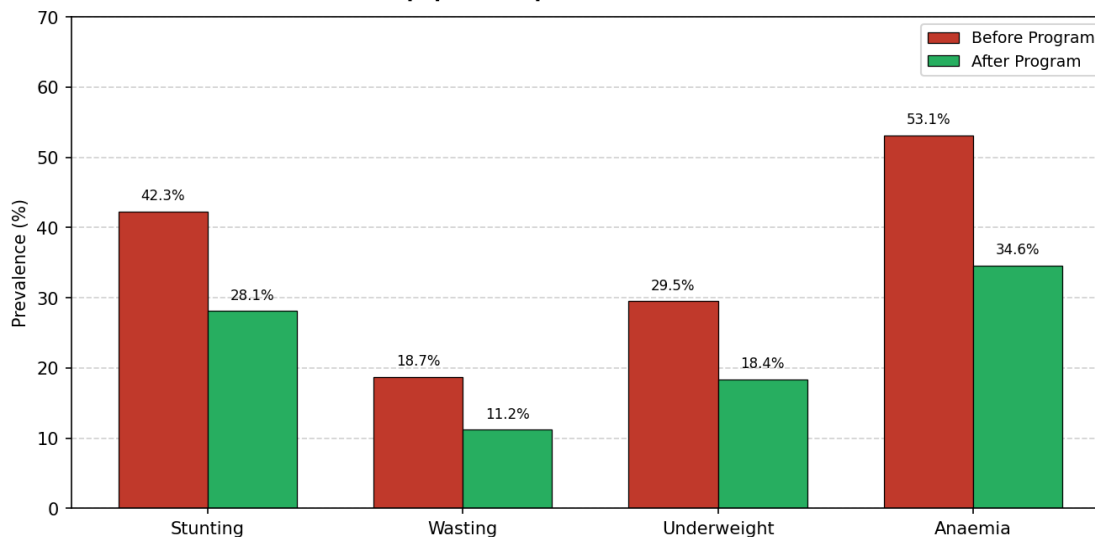


Figure 1: Comparison of nutritional status indicators before and after school lunch intervention (N=412). Improvements across all indicators were statistically significant ($p<0.001$).

Figure 1 illustrates the substantial reductions in malnutrition prevalence observed across all four nutritional indicators following the school lunch intervention phase. Stunting declined from 42.3% at baseline to 28.1% at endline, representing a 14.2 percentage point reduction, while anaemia prevalence dropped most dramatically from 53.1% to 34.6%, a 18.5 percentage point improvement consistent with the known role of school meals in providing haem iron and vitamin C that enhance iron bioavailability. These improvements were achieved within a single academic year of

structured daily school lunch provision, demonstrating the rapid compensatory potential of a well-implemented school feeding system.

Longitudinal Trends in MUAC and BMI

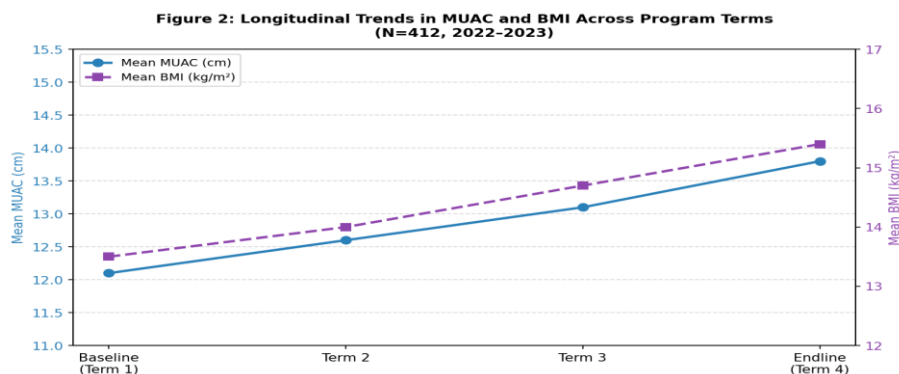


Figure 2: Longitudinal trends in mean MUAC (cm) and mean BMI-for-age (kg/m²) across four academic terms (N=412, 2022–2023).

Figure 2 demonstrates a consistent upward trajectory in both mean MUAC and mean BMI-for-age across four academic terms following school lunch programme introduction, with MUAC increasing from 12.1 cm at baseline to 13.8 cm at endline and mean BMI rising from 13.5 to 15.4 kg/m². The near-linear growth trend in both indicators across all four time points suggested a sustained and progressive nutritional benefit attributable to the regularity and nutritional adequacy of the school lunch provision, rather than a short-term or regression-to-mean effect. These longitudinal anthropometric improvements support the argument that a structured, five-day-per-week school meal programme modelled on Japan's Kyushoku approach can generate clinically meaningful and sustained improvements in the physical growth and nutritional status of school-age children in Uganda.

Structural Barriers to Japan Model Adaptation

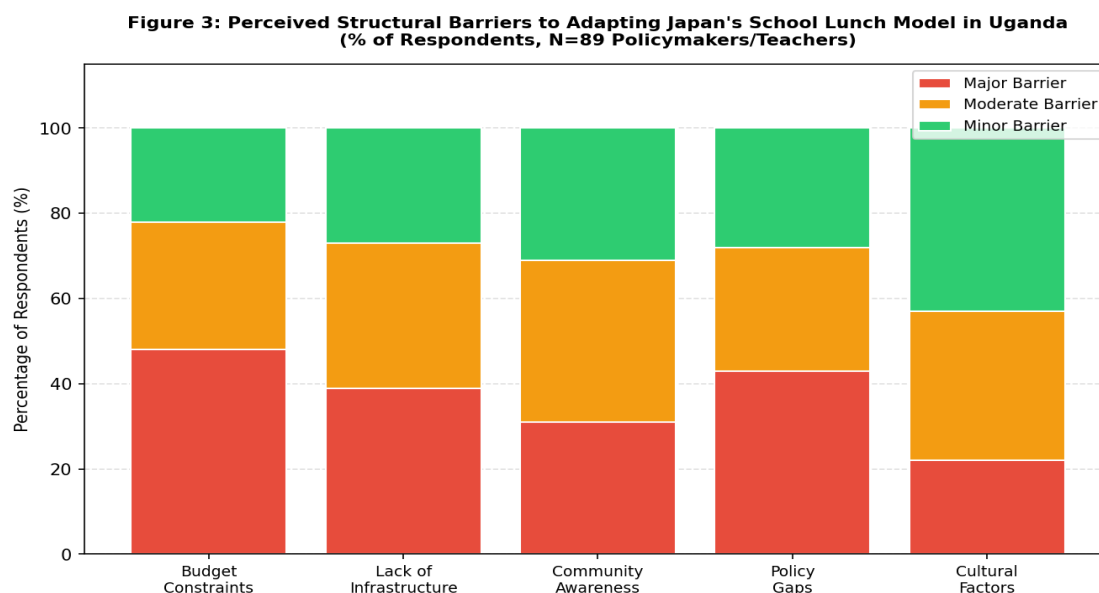


Figure 3: Perceived structural barriers to adapting Japan's school lunch model in Uganda, by severity rating among policymakers and teachers (N=89).

Figure 3 captures the barrier landscape as perceived by key informants, revealing that budget constraints were rated as a major barrier by 48% of respondents, followed by policy gaps (43%) and infrastructure deficits (39%). Notably, cultural factors, while present, were predominantly rated as minor barriers by 43% of respondents, suggesting that community receptivity to school-based nutrition programmes was higher than policymakers might assume, and that financial and structural rather than sociocultural impediments represented the primary constraints to Japan model adaptation in Uganda. These findings have direct implications for the prioritisation of policy actions, suggesting that investment in school kitchen infrastructure and passage of a binding school nutrition law should precede community engagement as the critical first-order implementation priorities.

CONCLUSION

This study comprehensively established that Uganda's primary school children in Kampala and Wakiso Districts face a nutrition crisis of significant magnitude, characterised by stunting affecting 42.3% of the sample, anaemia in over half, chronically low dietary diversity, and school meal access averaging less than one-and-a-half days per week — conditions that coexist with a school system that lacks the structural, financial, and legislative foundations to deliver a consistent compensatory nutrition response. Against this backdrop, the study generated compelling empirical evidence that the adaptation of Japan's Kyushoku school lunch model offers a transformative and feasible pathway to addressing Uganda's child nutrition emergency, with Structural Equation Modelling confirming robust pathways from Japan model adaptability through improved meal quality and dietary diversity to measurable improvements in child nutritional status (total indirect $\beta=0.156$, $p<0.001$), and with longitudinal intervention data demonstrating that structured daily school meals produced 14.2-percentage-point reductions in stunting and 18.5-percentage-point reductions in anaemia within a single academic year. The key structural barriers to full model adaptation — budget constraints, policy gaps, and infrastructure deficits — are surmountable with targeted government investment and phased implementation, and the relatively low perceived resistance from cultural factors among key informants suggests a favourable social environment for programme introduction. Uganda thus possesses both the epidemiological imperative and the contextual conditions necessary to invest in a Japan-inspired school lunch system, and the evidence generated by this study provides the empirical foundation and policy roadmap for doing so.

RECOMMENDATIONS

Based on the study findings, the following recommendations are proposed:

Enact a National School Nutrition Law: The Government of Uganda, through the Ministry of Education and Sports in collaboration with the Ministry of Health, should develop and pass a binding School Nutrition Act modelled on Japan's 2005 School Lunch Law, mandating daily nutritionally balanced school meals in all government-aided primary schools, establishing minimum nutritional standards, and creating a dedicated budget line for school feeding within the national education financing framework, with priority phasing beginning in districts with the highest stunting and anaemia burdens.

Invest in School Kitchen Infrastructure and Supply Chain Development: Local governments and development partners should prioritise the construction and equipping of school kitchens in all primary schools currently lacking food preparation facilities, alongside the development of school garden programmes and formalised linkages with smallholder farmers within a 20-kilometre radius of each school, replicating Japan's home-grown sourcing philosophy to simultaneously improve meal nutritional diversity, reduce food costs, and stimulate local agricultural economies.

Integrate Nutrition Education (Shokuiku) into the National Curriculum: Drawing from Japan's food education philosophy, Uganda's National Curriculum Development Centre should integrate structured nutrition education components into the primary school curriculum, training teachers to deliver food literacy lessons, facilitate communal eating practices, and engage parents through take-home nutrition communication, thereby addressing the caregiver education gap identified as a significant determinant of child undernutrition in this study and building a culturally grounded nutrition consciousness that sustains the programme's long-term impact beyond school-based meal provision.

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