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Bridging policy design and implementation gaps in school feeding programmes : Experimental evidence from Benin

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Abstract

Despite the rapid expansion of Benin's National Integrated School Feeding Programme (PNASI), dietary diversity within school meals remains limited. This study examines the policy-implementation gap in delivering healthy, diverse school meals and evaluates whether a locally co-designed, integrated intervention combining nutrition education and school gardens can strengthen the sustainability of the National Integrated School Meals Programme (PNASI: *Programme National d'Alimentation Scolaire Intégrée*) in Benin. A cluster-randomized controlled trial was conducted over two academic years (2023-2025) across 8 primary schools drawn from a baseline sample of 12 schools in Cotonou, Abomey-Calavi and Sèmè-Kpodji, building on a 2023 baseline assessment and four focus group discussions with local stakeholders that informed the intervention's co-design. Nutrition education produced substantial knowledge gains in intervention schools relative to controls, particularly regarding food group functions and dietary diversity. Daily fruit consumption rose significantly among intervention schoolchildren (+8.3%, <0.01 vs -0.1%, >0.05 in the control group), with the largest gains where education was paired with a school garden, while control schools showed no improvement. The proportion of children with a well-diversified diet declined significantly among controls, but the decline in intervention schools was not statistically significant, suggesting the intervention buffered children against a broader, programme-wide decline in dietary diversity. These findings show that community-engaged, garden-based nutrition education can improve children's nutrition knowledge and fruit consumption, even where household-level constraints limit overall dietary diversification. Scaling this integrated approach within PNASI, alongside complementary household-level actions and long-term monitoring and evaluation, could help translate national policy ambitions into lasting, measurable improvements in the school meals across Benin.

Keywords: School meal programme, nutrition education, school gardens, dietary diversity, randomized controlled trial, Benin

Introduction

Benin, a West African country of nearly 15 million people (1), continues to face a substantial public health and nutrition burden, with approximately one third of children under five affected by stunting (2), while nutritional vulnerabilities also persist among school-aged children and adolescents. In response, the Government of Benin, with support from the World Food

Programme, has implemented the National Integrated School Meals Programme (PNASI), which now covers 75% of schools and prioritises locally produced foods to improve access to nutritious meals among schoolchildren. However, dietary diversity within school meals remains limited since the basic food basket provided to schools through the program consists mainly of essential food items, including grains (rice and corn), legumes (cowpeas and yellow peas), oil, and iodized salt (3). The Alliance of Bioversity International and CIAT, in collaboration with the University of Abomey-Calavi, is supporting the development of sustainable approach for strengthening the PNASI by addressing the gap between policy design and implementation through community engagement and the creation of healthy Food School Environment (FSE) (4). The effect of this approach was tested using a randomized controlled trial (RCT) conducted under the EU funded Healthy Food Africa project. The design ran over two academic years across eight primary schools (four interventions and four controls) in two suburban municipalities in southern Benin (5). The intervention package was co-designed with local school communities, based on findings from a 2023 baseline study that identified the barriers and enabling factors for a more sustainable and healthy PNASI (6,7). This study aim was to test the effectiveness of a participatory co-creation approach within the PNASI and assess whether a participatory and locally designed intervention package could strengthen the implementation of sustainable and healthy school meals in Benin.

Material and Methods

A diagnostic study was conducted in 2023 in three municipalities of southern Benin: Cotonou (urban), Abomey-Calavi and Sèmè-Kpodji (peri-urban) using a mixed-methods approach across 12 randomly selected PNASI schools (4 schools per municipality). This study characterised children's diets, nutritional status and school food environments using dietary recalls, anthropometric measurements, and structured food safety and availability surveys. The food school environment was assed via an observational survey indicating the number of food groups available at the school level (6,7). The food groups followed the dietary diversity groups proposed by Adeomi et al. (8). A score of '1' was assigned when a food group was identified at the school level while a score of '0' was assigned when it was absent. The median score of 8 out of 15 was used as the threshold to determine good diversity in food availability.

Height and weight were measured for each student aged 7–14 years using a portable height board and a digital weighing scale, respectively. Age was obtained directly from students and verified against their birth certificates. Height-for-age (HAZ) and BMI-for-age (BAZ) z-scores were calculated using the WHO 2007 Growth Reference for children and adolescents aged 5–19 years, with WHO AnthroPlus software. Stunting (HAZ < −2 SD), thinness (BAZ < −2 SD), overweight (BAZ > +1 SD) and obesity (BAZ > +2 SD) were defined according to WHO cut-offs.

Several focus group discussions with school actors/local stakeholders including schoolchildren, cooks, parents, teachers, local authorities, were conducted to translate these findings into a locally co-designed intervention package. This package was tested through a RCT over two academic years, comparing 4 intervention schools with 4 matched control schools continuing standard PNASI implementation. The RCT was conducted in municipalities facing the most critical situations in terms of dietary practices and malnutrition and that also had the potential to implement the intervention (such as the availability of land for establishing gardens): Abomey-Calavi and Sèmè-Kpodji. The intervention combined weekly nutrition

education sessions covering dietary diversity and improved cooking processes in four intervention schools with school gardens established in two of the intervention schools to supply fresh fruits and traditional vegetables to canteens.

We targeted specific indicators such as schoolchildren's nutrition knowledge and dietary practices. KAP was assessed through an adapted version of KAP FAO guidelines (9) and consumption data was assessed using a 24h recall over two not consecutive days reaching 600 students (75 per school). The food consumption data were used to measure dietary diversity in the target group as previously piloted by Adeomi et al. (8). Fifteen food groups were retrieved from the 24h recall based on ingredients constitutive of cited consumed foods and the median score of 8 was used as the threshold to determine good dietary diversity.

The intervention was evaluated using a mixed-methods approach, combining quantitative and qualitative data collected at pre and post-intervention assessments. Changes in outcomes over time were compared between intervention schools and control schools that did not receive the intervention, thereby enabling assessment of the intervention effect while accounting for temporal changes in the outcomes. In this abstract, we focused on schoolchildren knowledge among diversified diet and food groups as well as their dietary practices. Varied/diversified diet is defined as regular consumption of a variety of foods from different food groups. We keep the easiest option (3 groups) considering the age of schoolchildren (10). Target dietary practices from the 24hr recall were the consumption of fruit (yes/no) and having diversified diet (have eaten at least 8 food groups out of the 15). Additionally, to highlight changes in the intervention group, we evaluated Dietary species richness (DSR) score, Fruits and vegetables species diversity, Fruits species diversity and Vegetables species diversity adapted from Lachat et al. (11).

Results and Discussion

Diagnostic situation

Food environments lacked diversity in 75% of schools, and local procurement remained limited, reflecting weak integration of value chains. Micronutrient-rich foods (provide examples) were largely absent from school meals.

Baseline situation

Schoolchildren showed low dietary diversity at the baseline with an average dietary diversity score of 5.8±5.4 groups out of 15. Moreover, fewer than 22% of children consumed fruits and vegetables on a daily basis.

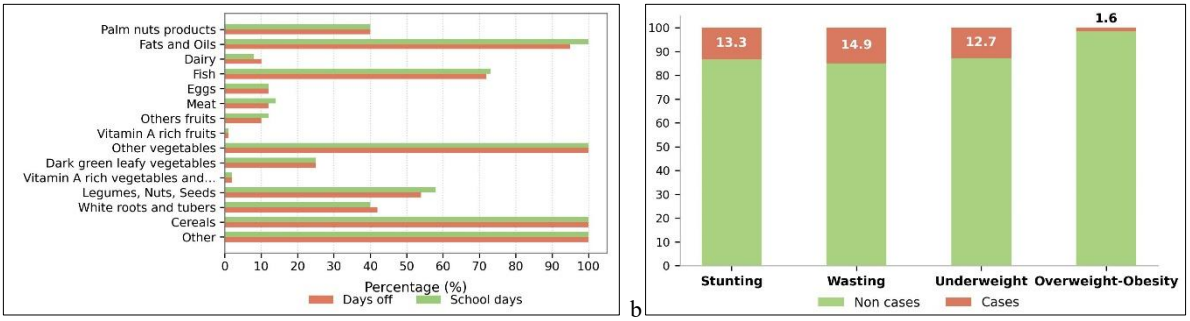


Figure 1: Percentage of schoolchildren according to (a) food group consumption and (b) type of malnutrition

These findings were shared and discussed with communities through FGDs, and directly informed the co-design of an intervention combining nutrition education and school gardens.

Effectiveness of the integrated intervention package

Nutrition education had a marked, positive effect on children's knowledge and practices. Knowledge of food groups and what constitutes a varied diet increased from the baseline in intervention schools than in control schools. The same trend was also observed for knowledge gains among specific food group functions (Table 1). These results corroborate studies by Cown et al. (12) and Shariff et al.(13), reinforcing the relevance of the educational approach in diverse cultural contexts.

Effects on dietary practices were more mixed but nonetheless encouraging. Daily fruit consumption increased by 8.3 percentage points in intervention schools, while remaining essentially flat among controls. There was also a greater consumption of fruit by schoolchildren who had attended nutrition education sessions reinforced by the installation of gardens (+9.0 percentage points) than in schools that had only benefited from nutrition education sessions (+7.7 for the nutrition education only). This increase could be linked to changes in food access or availability. Moreover, proportion of children consuming a well-diversified diet declined sharply in control schools, while intervention protected dietary diversity against a backdrop of decline (Table 1).

Table 1: Change in schoolchildren's nutrition knowledge and dietary practices, within group comparison, baseline vs endline, control vs. intervention schools (n=600)

Knowledge and Practice indicators	Control Δ%	p-value	Intervention Δ%	p-value*
Nutrition knowledge				
Schoolchildren who know the food groups and what a varied/diversified diet means	- 7,6	< 0.001	+ 72,6	< 0.001
Schoolchildren who know about strength foods	+ 38.7	< 0.01	+ 88.5	< 0.01
Schoolchildren who know about growth foods	+ 11.2	< 0.01	+ 90.7	< 0.01
Schoolchildren who know about protective foods	+ 2.6	< 0.01	+ 97.6	< 0.01
Dietary practices				
Eats fruit at least once a day	−0.1	>0.05	+8.3	<0.01
Has a diversified diet	−7.6	<0.05	−2.1	>0.05

*** Chi- Square** test

A similar pattern was observed for parameters related to dietary species richness among intervention groups. This is mainly driven by lower fruit-and-vegetable and vegetable consumption overall, yet fruit consumption alone still posted a small, encouraging increase (Table 2).

Table 2: Dietary species richness related factors (mean scores) pre and post among intervention groups

Parameters	Baseline	Endline	p-value
Dietary species richness (DSR) score	7.56 ± 2.17	6.53 ± 2.35	<0.001
Fruits and vegetables species diversity	2.32 ± 0.85	2.01 ± 0.97	0.000
Fruits species diversity	0.10 ± 0.334	0.14 ± 0.42	0.048
Vegetables species diversity	2.21 ± 0.76	1.87 ± 0.86	0.000

The declines in dietary diversity likely reflect contextual and structural constraints such as seasonal food availability and household economic conditions rather than a failure of the intervention itself, and are consistent with the fact that nutrition sessions reached the school gate more effectively than the households.

Qualitative assessments showed that parents had limited engagement with the education sessions despite home food remaining the largest share of children's overall diet. This is in line with prior evidence that the impact of nutrition education can be limited by food availability and accessibility at home (14), and that precarious socio-economic conditions can restrict dietary diversification despite improved awareness and knowledge (15,16).

Conclusions and Outlook

Combining nutrition education with school gardens improved children's nutrition knowledge and fruit consumption, as well as helped protect them from a broader decline in dietary diversity. However, change was gradual, as parents showed limited engagement and household-level constraints remained a barrier. Data analysis is still ongoing, and key findings may emerge from the comparison of intervention and control group outcomes. Policymakers should integrate this approach into PNASI, add nutrition education to the primary schools' curriculum, and set up long-term monitoring to keep implementation aligned with national strategy.

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