Bouillon Fortification in Nigeria: Modeled Evidence

Key Policy Messages Related to Bouillon Fortification for Nigeria

- The prevalence of micronutrient inadequacies are substantial for women and young children, especially zinc and vitamin B12.
- Current national food fortification programs reduce micronutrient inadequacies, especially for folate.
- Bouillon cubes are widely consumed throughout Nigeria, including by poor households in rural and urban areas.
- Fortified bouillon cubes can further reduce micronutrient inadequacies, but dietary gaps remain at modeled levels of fortification, especially for vitamin B12 and zinc.
- The Standards Organization of Nigeria established voluntary standards for bouillon fortification, including iron, folic acid, zinc, and vitamin B12 at levels approximately equivalent to 15% of Codex Nutrient Reference Values in 2.5 grams bouillon.
- Implementing a bouillon fortification program will require public- and private-sector investments.

Rationale and Objectives

Rationale: Micronutrient deficiencies impact health, growth, and development.[1] Bouillon is widely consumed in Nigeria, including among rural and poor populations,[1] and hence has the potential to deliver micronutrients to at-risk individuals.

Objectives: This research used national data from Nigeria to: (1) assess dietary inadequacy of iron, zinc, vitamin A, folate, and vitamin B12 among women of reproductive age (WRA) and children 6-59 month of age; (2) model the contributions of existing large-scale food fortification (LSFF) programs to addressing micronutrient gaps; and (3) model the potential contributions of fortified bouillon to further meeting dietary requirements and to reducing child mortality. Fortification program costs and cost-effectiveness were also assessed.

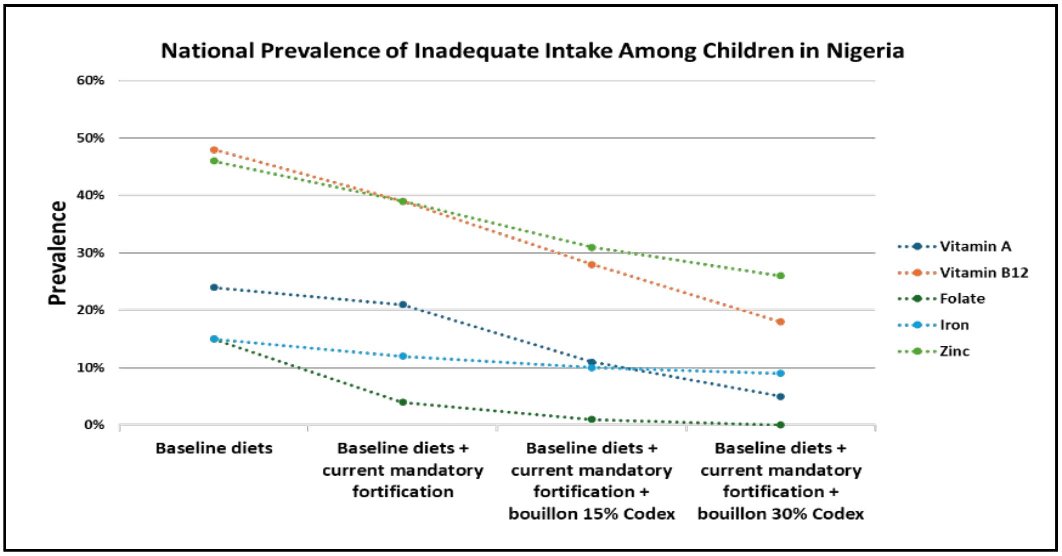
Methods

We used household food consumption data from the 2018/2019 Nigeria Living Standard Survey (NLSS)[2] plus data from the 2021/22 national survey[3], and the Micronutrient Intervention Modeling Project's nutritional needs/benefits model (MINIMOD-SD) to estimate the prevalence of dietary micronutrient inadequacies and to model the contributions of various combinations of fortification programs to reducing inadequacies. The Lives Saved Tool (LiST)[4] was used to estimate the impacts of fortification on child mortality. The MINIMOD cost model[5] estimated the start-up and operational costs of hypothetical bouillon programs over 10 years, disaggregated by government, industry, and premix costs.

Results: Micronutrient inadequacies in Nigeria & programs to address them

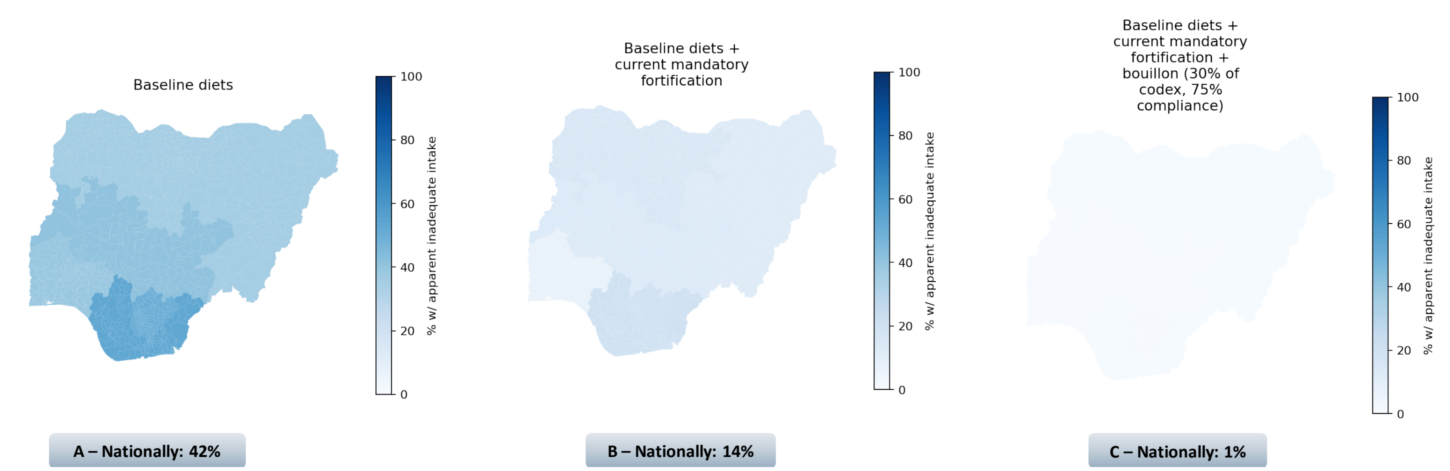
Nationally, based on unfortified food sources alone, inadequacies in vitamin A (VA), vitamin B12, folate, iron, and zinc are common among children, especially for vitamin B12 and zinc (**Figure 1**). Wheat/maize flour, refined oils, sugar, and margarine fortification programs deliver VA; wheat/maize flour programs also deliver folic acid, vitamin B12, iron, and zinc. Bouillon fortification providing 30% of Codex Nutrient Reference Value (NRV) in 2.5 grams bouillon would decrease inadequacies among children, modestly for iron.

Figure 1: Prevalence of micronutrient inadequacies among young children, by intervention program scenario



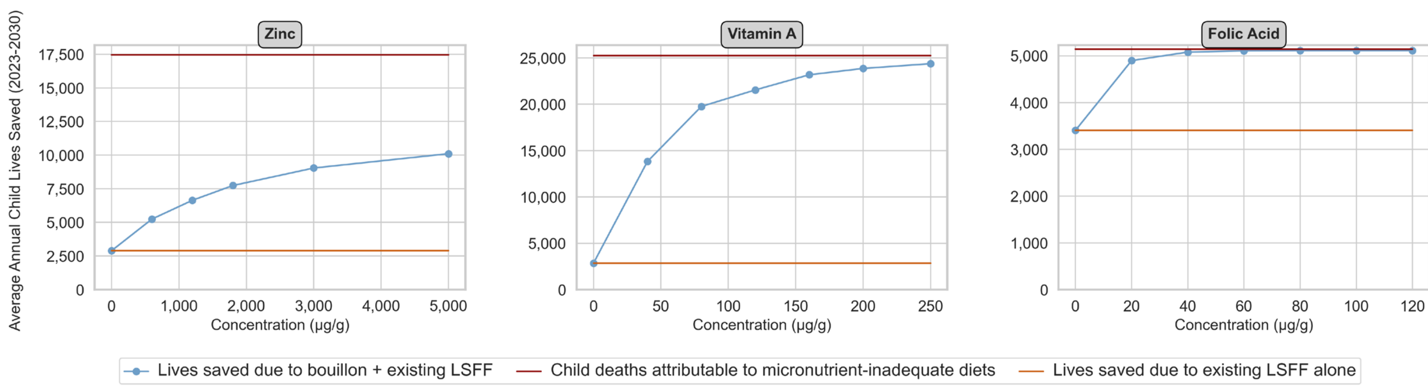
Regional variations exist in both inadequacy levels, and the impacts of LSFF and potential bouillon fortification programs. For example, based on natural food intake alone, 42% of WRA nationally have dietary inadequacy of folate (**Figure 2A**), ranging from 53% in the South South zone to 35% in the North East and North West zones. Wheat/maize flour fortification contributes substantially to reducing national inadequacy to 14% with similar subnational patterns (**Figure 2B**). Bouillon fortified at 30% of Codex NRVs in 2.5g (**Figure 2C**) would decrease national inadequacy to 1%, essentially eliminating this public health problem.

Figure 2: Prevalence of <u>folate</u> inadequacy among WRA; various model scenarios



Reductions in folate inadequacy among WRA, and in VA and zinc inadequacies among children, can lead to reductions in child mortality.[4] **Figure 3** illustrates the potential number of lives saved among preschool children (< 5 years) at different levels of fortification of bouillon (independently) with zinc, VA, and folic acid, respectively. The red line in each figure shows child deaths attributable to dietary inadequacy of each micronutrient. The lower orange line shows child-lives saved by existing LSFF programs. Bouillon fortification with any of these micronutrients could save children's lives, although zinc and VA fortification would impact a larger absolute number of children than folic acid.

Figure 3: Lives saved by different levels of bouillon fortification among children 6-59 months in Burkina Faso



Results: Bouillon fortification program costs and cost-effectiveness over 10 years

Public-sector and private-sector investments will be required to design and launch (modeled over two years), and manage bouillon fortification programs (modeled over eight years).[5] Planning costs are substantial for government (**Figure 4A**), while equipment investments are the main start-up cost driver for industry (**Figure 4B**).

Figure 4A: Hypothetical bouillon fortification program: start-up costs, by cost category, Government

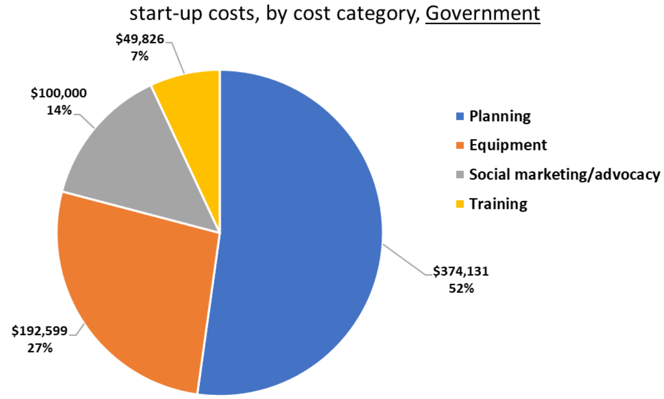
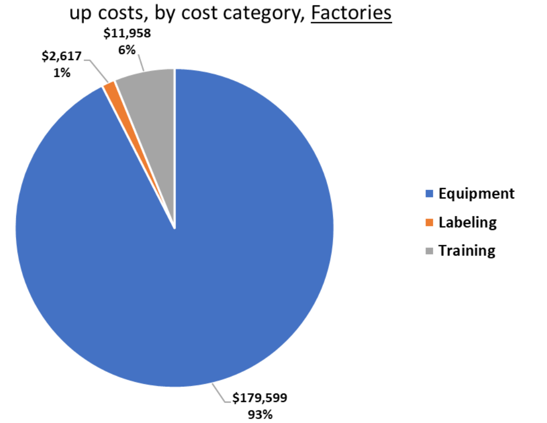


Figure 4B: Hypothetical bouillon fortification program: start-up costs, by cost category, Factories



Operational costs for government for bouillon fortification programs (**Figure 4C**) are mainly comprised of import monitoring, training/retraining and factory inspections and monitoring. Operational costs for industry (**Figure 4D**), on the other hand, are dominated by the management of premix flows (purchasing, shipping, storing, etc.) and to a lesser extent by managing the fortification process internally (fortification and QA/QC activities). Once operational in year 3 of the model simulation period, the annual cost of the flow of premix required by a program designed to meet 30% of Codex NRVs for all five micronutrients for WRA consuming 2.5g of bouillon per day is ~$76m, or ~$0.001 per 2.5 gram serving.

Figure 4C: Hypothetical bouillon fortification program: non-premix operational costs, by cost category, Government

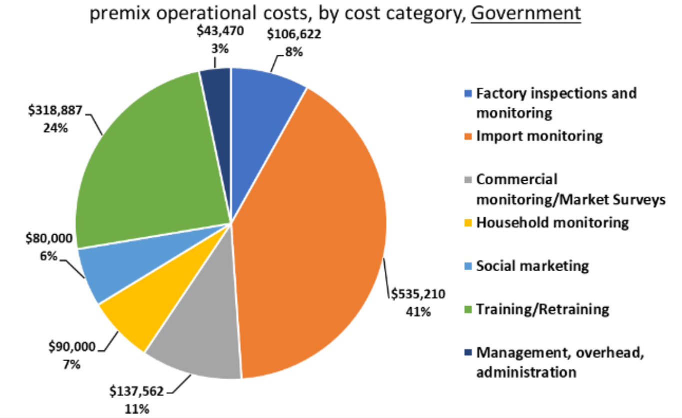


Figure 4D: Hypothetical bouillon fortification program: non-premix operational costs, by cost category, Factories

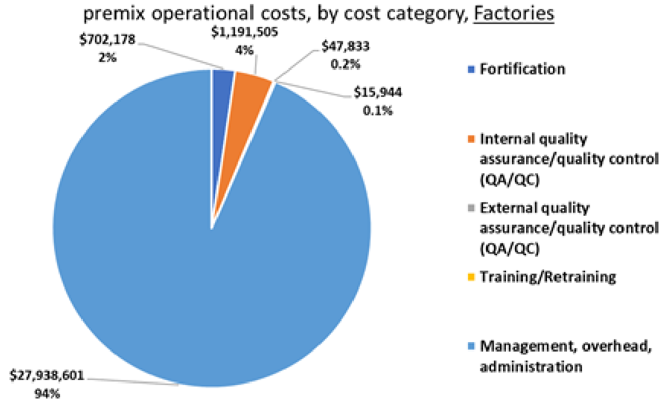
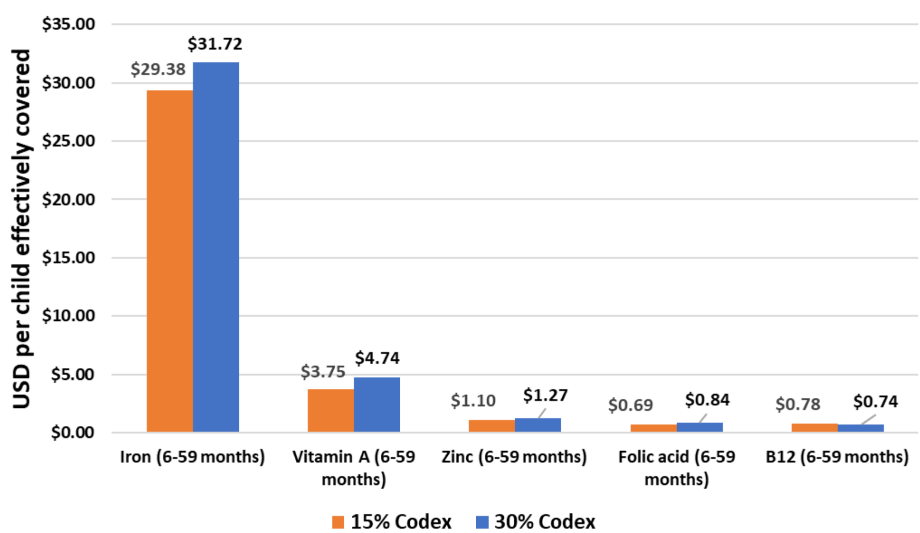


Figure 5 reports the cost-effectiveness of bouillon fortification for each of the micronutrients included in this study, at fortification levels equivalent to 15% and 30% of Codex NRV for WRA consuming 2.5g/day. Fortificant costs and (especially) absorption make iron the least efficient. VA is more cost-effective than iron, and zinc, folic acid, and B12 are the most efficient in terms of reducing micronutrient-specific dietary inadequacy per dollar invested.

Figure 5: Cost-effectiveness of alternative micronutrient intervention programs, young children, by micronutrient



Partners and Funding

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Further information

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