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Case Study

Nigeria and Zambia Large-Scale Food Fortification Needs Assessment and Design Pilot: Challenges and Lessons Learned

Tool 3 of 3 in the LSFF Methodology Series

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Abbreviations and Acronyms

AFE	adult female equivalent
DAI	Development Alternatives Incorporated
ENHANCE	Environment, Nutrition, and Health Analytics for National, Consumer, and Emergency Diets
FAO	Food and Agriculture Organization of the United Nations
FCT	food composition table
GoZ	Government of Zambia
LCMS	Living Conditions Monitoring Survey
LSFF	large-scale food fortification
NLSS	Nigeria Living Standards Survey
USAID	U.S. Agency for International Development

Challenges and Lessons Learned in Piloting the Methodology to Assess Diets, Markets, and Diet Cost to Inform Large-Scale Food Fortification

This case study is part of a package of three tools for needs assessment and design of large-scale food fortification (LSFF) programs for improved diets. First read the *Operational Overview: Needs Assessment and Design Methodology to Guide Large-Scale Food Fortification and Broader Programming to Improve Diets*, which provides the basic steps and a data decision tree to **conduct a needs assessment and analyze existing data to inform LSFF design or redesign**. For detailed instructions on how to conduct the analyses for the needs assessment and design, see the *Methods Guide: Needs Assessment and Design Methodology to Guide Large-Scale Food Fortification and Broader Programming to Improve Diets*. For examples of challenges and lessons learned in applying the methodology read this case study document.

The methodology includes three steps. Each step includes a decision tree for finding the most suitable data sources for the analyses.

Step 1: Needs Assessment, to estimate the adequacy of micronutrient intake/supply and help identify which micronutrients LSFF or other interventions might provide because they are insufficient in the diet.

Step 2: Design/Redesign, to a) estimate fortifiable food consumption and help suggest which centrally processed foods that are consumed could potentially serve as food vehicles for fortification; b) estimate the availability of fortifiable and fortified foods in markets to help stakeholders to better understand if these foods are available to populations vulnerable to inadequate micronutrient intake; and c) model the contribution of fortifiable foods to micronutrient adequacy to help define and set the fortification program goals.

Optional Step: Modeling Diet Cost and Affordability, to estimate the cost and affordability of the diet without and with LSFF, which can help demonstrate how a fortified food may affect the affordability and accessibility of a micronutrient adequate diet compared to a diet without food fortified through LSFF.

The purpose of the case study is to describe our efforts to test the usefulness of the tools and give examples of the challenges in the analysis process and lessons learned in addressing them. USAID requested that we develop the methodology in 2021. We finalized the draft methodology in 2022. We applied the methodology in Nigeria and Zambia from January to June 2023. Here, we briefly provide background information on the pilot study and then describe five key challenges and what we learned from them.

Background on the Pilot Study: LSFF in Nigeria and Zambia

Nigeria

The Government of Nigeria has adopted LSFF as one of its strategies to overcome inadequate micronutrient intake. In 1993 the Government of Nigeria mandated fortification of salt with iodine (FGN and IITA 2022). In 2002 it expanded mandatory LSFF to include sugar, margarine, and edible oil with vitamin A and semolina, maize, and wheat flours with vitamin A, vitamin B1 (thiamin), vitamin B2 (riboflavin), vitamin B3 (niacin), vitamin B6 (pyridoxine), vitamin B9 (folic acid), vitamin B12 (cobalamin), iron, and zinc (Anjorin, Okpala, and Adeyemi 2019). Results from the most recently available food consumption and micronutrient survey indicate micronutrient deficiencies are common in Nigeria (Anjorin, Okpala, and Adeyemi 2019), however, this data is from 2001. Lack of use of recent data in our methodology can result in findings that lead to inappropriate LSFF programming decisions, if the data do not accurately reflect the current food consumption and micronutrient situation. In 2021 the government, with donor support, conducted a new national food consumption and micronutrient survey. Final, up-to-date estimates of micronutrient deficiencies and intake will be available upon publication of the full survey report, anticipated in 2024. In Nigeria, we piloted our Operational Overview and Methods Guide using the Nigeria Living Standards Survey (NLSS) 2018–2019 (NBS 2020). The NLSS collected data on household food consumption in the seven days prior to the survey. We also used 2021 market assessment data commissioned by the Global Alliance for Improved Nutrition (GAIN 2021). We formed a stakeholder group composed of individuals with experience and/or knowledge of micronutrient deficiencies, intake, or programs; LSFF; and/or markets from government, non-governmental organizations, academic professionals, the private sector, donors, and United Nations agencies to provide feedback on the process, modeling inputs, and results.

Zambia

Zambia has had mandatory fortification of salt with iodine since 1994, sugar with vitamin A since 1998, and margarine with vitamins A and D since 1978 (Harris et al. 2017). Fortification of wheat and maize flours is voluntary. Efforts to legislate mandatory fortification of maize flour have failed on two occasions. There are no regulations, laws, or standards for fortification of rice or edible oil. The Government of Zambia (GoZ) includes LSFF as one strategy to help address inadequate vitamin A and iodine intake. Vitamin A deficiency is a public health problem in the country (Mofu and Chileshe 2022). Data from 2012 shows that adult women were not iodine deficient (NFNC 2012), which may provide evidence that at that time, the program to fortify salt with iodine was helping to alleviate inadequate iodine intake. Iron deficiency and iron deficiency anemia are public health problems in Zambia (Mofu and Chileshe 2022). Vitamin B12, folate, and zinc deficiency are also considered problems, although the available evidence is over 15 years old (Alaofè et al. 2014).

In 2020–2021 the GoZ conducted a national food consumption and micronutrient survey that included collection of 24-hour dietary recall data, samples of fortified foods to estimate nutrient content, and biological samples to test for selected micronutrient deficiencies. At the time we conducted the pilot of the methodology, the GoZ had not yet finalized their report and the data were not available for secondary analysis. In Zambia, we piloted our methodology using the 2015 Living Conditions Monitoring Survey (LCMS) implemented from April to May 2015 (Central Statistical Office 2016). We also used various sources of market data,[1] provincial-level food prices of food commodities, and consumer price index data. The 2015 LCMS collected data on food acquisition over the prior four weeks for maize grain (shelled and unshelled), breakfast mealie meal, roller meal, hammer mealie meal, pounded maize meal, salt, spices, and cooking oil, and over the past two weeks for the remaining food items. Similar to Nigeria, in Zambia we also formed the same type of stakeholder group to provide feedback on the process, modeling inputs, and results.

Key Learning: The Importance of Stakeholders

One key learning that is a common thread throughout the challenges and lessons learned below is the **critical importance of working with a country stakeholder group to provide inputs to the modeling parameters and to discuss the results**. Our analysis would not have been possible without the input from the stakeholder groups. Our experience confirmed the importance of the emphasis on the formation of the stakeholder groups in the Operational Overview and its annex that includes an example of a stakeholder group terms of reference. We met with stakeholders as a group, one-on-one, and in smaller groups as needed, and shared short surveys with members to obtain feedback on parameters, results, and processes. We formed the stakeholder groups at the beginning of our work. We worked with consultants knowledgeable about LSFF and nutrition in each country to create the initial list of stakeholders to invite to the group. Stakeholder group participants recommended colleagues to join throughout the process. (For more details on what this process could look like, please see the Operational Overview.) We had invited 31 individuals in Nigeria and 21 in Zambia to the stakeholder meetings, and during our final meeting, the Nigeria and Zambia stakeholder groups both recommended that we invite even more stakeholders from various organizations working in LSFF, including government officials, to the meetings.

[1] Market data sources included Food and Agriculture Organization of the United Nations (FAO) Food Balance Sheets; Zambian Food Balance Sheets; data from the Central Statistics Office of the Zambian Ministry of Agriculture; free online portals; industry research; agriculture research reports; producer and retailer websites, Facebook pages, and LinkedIn posts; online business media articles; and previous relevant research (GAIN 2023).

Key Challenges and Lessons Learned in Implementing the Pilot Study

Challenge: Considering Industry Feasibility When Modeling the Contribution of Fortification to Micronutrient Adequacy

The steps in the methodology we developed include conducting a needs assessment to identify micronutrients consumed in inadequate amounts and the populations most affected, followed by an assessment of fortifiable food coverage and consumption, and then modeling the contribution of fortification to micronutrient adequacy. It also includes concurrent assessment of the availability of fortifiable foods in markets. USAID requested that TechnoServe and the Development Alternatives Incorporated (DAI) USAID-funded Market Systems and Partnerships project develop an additional methodology for data collection to assess industry readiness and capacity to fortify (Sunley et al. 2023). The industry assessment provides a range of information, including the overall feasibility of fortification, as well as estimates of the percent of the food vehicle that is fortifiable.

Our challenge was that we **modeled the potential contribution of fortification to micronutrient adequacy without first fully considering industry feasibility to fortify**. For example, because the Zambia stakeholder group requested that we model rice fortification, we proceeded without having a full understanding of the feasibility of rice fortification in Zambia or incorporating that understanding into discussions with them about food vehicle selection for modeling. The Zambia industry assessment results showed the feasibility for rice fortification was very low. Had we discussed these results with the stakeholder group during food vehicle selection, we may have collectively decided against modeling the potential contributions of rice fortification in Zambia to vitamins A, B6, and B12; thiamine; niacin; folate; iron; and zinc adequacy. Generally, while we had originally assumed that our series of methodology steps should come first, followed by the industry assessment, we learned from this experience the importance of linking decisions about modeling with the information obtained from the industry assessment.

Lesson learned: Start with the needs assessment, estimate fortifiable food consumption as part of the initial design/redesign step. Then look at the industry assessment, and the feasibility for industry to fortify the different food vehicles, and then model the contribution of LSFF to micronutrient adequacy considering the industry feasibility.

Challenge: Accurately Identifying Types of Oil Consumed to Estimate Contribution of Fortified Oil to Micronutrient Adequacy

The populations in Nigeria's geopolitical zones[2] consume different types of edible oil. We modeled the contribution of fortification to micronutrient adequacy considering edible oil that is "fortifiable", defined as oil produced by companies that process 15,000 metric tons or more per year (USAID 2022).[3] Oil produced by companies that process less than this amount, or artisanal or home processing of edible oil, was not considered fortifiable, primarily for two reasons—the cost to fortify is generally beyond what small industry can afford and it is difficult for the government to monitor fortification by many small producers. Large-scale industries process some of the edible oil consumed by Nigerians, and this is

[2] The geopolitical zones in Nigeria are North West, North East, North Central, South West, South East, and South South.

[3] Fortifiable food, as used in this document, refers to foods produced by formal and centralized industries that could be fortified according to national/regional/local legislation and standards, and that meet threshold estimates for what constitutes "large-scale" in low-income countries—see Annex 7 in the USAID LSFF Programming Guide (USAID 2022).

fortifiable, while small-scale industry or artisanal production also process oil, and these are not considered fortifiable.

However, the 2018–2019 NLSS food list included only "palm oil" and "groundnut oil". The Nigeria stakeholder group shared that populations consume soya bean, sunflower, cottonseed, coconut, groundnut, sesame seed, rapeseed, and refined palm oil, as well as unrefined red palm oil. The stakeholder group also shared that, in Nigeria when people are asked what kind of oil they consume, if they consume red palm oil they will say "palm oil" and if they consume refined oils they will usually say "groundnut oil" or just "oil" without distinguishing between different types of refined oils. The distinction between refined edible oils, particularly those processed by large-scale industries, is important because when we model the contribution of vitamin-A fortified oil to micronutrient adequacy, **we need to consider the percent of the edible oil that is fortifiable**, that is, processed by large-scale industries.

Given this situation, we managed the lack of NLSS differentiation between oil types in the following way.

1. Based on stakeholder group feedback, we assumed that when a household responded "yes" to consuming palm oil in the NLSS, they were referring to unrefined red palm oil, which already has naturally occurring vitamin A and is not considered fortifiable. So, we matched "palm oil" in the NLSS with the nutrient content of red palm oil.
2. Among the different kinds of refined oils consumed in Nigeria, like groundnut oil, refined palm oil, soybean oil, etc., it is very likely that people are not aware of the specific kinds of refined oils they are consuming. To determine how much of this oil could be fortifiable, we needed to disaggregate "groundnut oil" in the NLSS into groundnut oil, which we assumed is not refined at an industrial scale and therefore not considered fortifiable, and other refined oils processed at an industrial scale. Based on inputs from stakeholder group members' knowledge and experience in edible oil consumption in different regions of the country, we assumed that in the North Central geopolitical zone, that about 40 percent of refined oil consumption is groundnut oil, which is produced at small-scale and is not fortifiable, and the remainder is other types of refined oils that are potentially fortifiable (60 percent). The estimated percentages of fortifiable oil for other zones were: 50 percent in the North East and North West and 80 percent in the South East, South South, and South West zones.

Note that we were conducting our market assessment and modeling concurrently. Our market assessment also provided estimates on the percent of edible oil in Nigeria's geopolitical zones that are fortifiable. We found that the stakeholder group estimates for fortifiable oil consumption were generally similar to those of our market assessment results (less than a 20 percentage-point difference). In retrospect, however, we would conduct the market assessment and discuss edible oil processing and our results with the stakeholder group, refine our results based on stakeholder input, and then use the agreed upon values in our modeling.

Lesson learned: To estimate the contribution of edible oil fortification to micronutrient adequacy, conduct the market assessment, consulting with knowledgeable stakeholders to discuss national and subnational patterns of edible oil consumption and the percentage of edible oil processed by large-scale industries, and use the market assessment results as part of the process. Although this is also true for other fortifiable foods, such as wheat flour, maize flour, and rice, oil consumption can be particularly challenging due to the possibility of many different oil types and processing scales.

Challenge: Quality of Food Composition Tables

To accurately assess their nutrient content, we needed to match the foods in the NLSS and LCMS food lists to entries in food composition tables (FCTs) that were as close as possible to the nutrient content of foods available in the respective countries. For Nigeria, we matched food items to entries in the 2019

West African FCT (Vincent et al. 2020) and supplemented with the Malawi FCT (MAFOODS 2019) and Nutrition Data System for Research (University of Minnesota 2023)[4] for nutrient composition of foods. We matched each food with a food composition table entry or a weighted average of several entries, in the case of aggregate food items, to estimate daily apparent household energy and micronutrient intake.

In Zambia, we matched the LCMS food list with the foods in the Zambian FCT (NFNC 2009) and other FCTs as necessary and appropriate (Vincent et al. 2020). We consulted with stakeholders in Zambia and the FAO International Network of Food Data Systems food guidelines for food matching as needed (FAO/INFOODS 2012). For any food items that we could not match to the primary FCT, or for any nutrient information that was missing, the values were drawn from other appropriate FCTs in this order of priority: Malawi FCT, West Africa FCT, and U.S. Department of Agriculture FCT (USDA 2023). Similar to Nigeria, for aggregate food items, we used a weighted average of several entries to estimate daily apparent household energy and micronutrient intake.

When we reviewed the Zambia results, we found that **inadequate zinc intake appeared low** given the nutrition situation. We investigated possible reasons for the low levels of inadequate zinc intake and found that the zinc content of breakfast mealie meal in the Zambia FCT was unusually high—10 times higher than the hammermill mealie meal, while the content of other micronutrients was similar between the two FCT entries. We consulted with stakeholders in Zambia who identified the zinc level as a probable data entry error and recommended we use the same zinc value as the hammermill mealie meal. We conducted the needs assessment, modeling, and cost of the diet analyses with the updated zinc content and found the new results better aligned with what we would expect. In addition, we found that the nutrient contents of mango in the Zambia FCT included folic acid. Since folic acid is synthetic, it cannot be contained in foods without fortification. Therefore, we corrected for this when we conducted the analysis.

Lessons learned: Carefully select FCTs for use in the analysis and match, analyze, and review FCT entries for possible errors and/or outliers, and discuss errors/outliers with stakeholders in the country, as this will help ensure the most appropriate FCT matches and save time and funds by avoiding the need to re-analyze data.

Challenge: Interpreting Adult Female Equivalent and Nutrient Density Results

We estimated micronutrient inadequacy using two different methods—adult female equivalent (AFE) and nutrient density.

- Considering the adult female's food consumption is approximately the household average and the adult female has high micronutrient requirements, the adult female is the reference for the household. To estimate **micronutrient adequacy per AFE**, we calculated AFE weights for each household member as the ratio of the household member's energy requirements to the energy requirements of an adult female aged 18–29.9 years, assuming moderate physical activity levels. We calculated the total AFEs in the household by summing all members' AFE weights. The AFE method assumes the intrahousehold distribution of food is proportional to each household member's age- and sex-specific energy requirements. To calculate apparent intake per AFE, we took the total daily apparent household micronutrient intake divided by the household AFEs. We then compared the apparent intake per AFE to the micronutrient requirement (harmonized

[4] The Nutrition Data System for Research is a Windows-based dietary analysis program designed for the collection and analyses of 24-hour dietary recalls and the analysis of food records, menus, and recipes. The system is developed and maintained by the University of Minnesota Nutrition Coordinating Center (ncc.umn.edu).

average requirement, Allen, Carriquiry, and Murphy 2020) for the non-pregnant, non-lactating adult woman 18–29.9 years of age.

- For the **nutrient density method,** we use an energy adjusted estimate of household micronutrient intake. For each micronutrient of interest, we estimated the apparent nutrient density of the household diet as daily apparent nutrient intake per 1,000 kilocalories, calculated by taking the total daily nutrient intake divided by the total daily energy intake in kilocalories, and multiplied by 1,000. We estimated the nutrient density of the household diet and then compared the nutrient density of the household diet to the critical nutrient density for the non-pregnant, non-lactating adult woman 18–29.9 years of age. The critical nutrient density is the ratio of the harmonized average requirement to the estimated energy requirement, multiplied by 1,000, where we define the nutrient and energy requirements relative to the non-pregnant, non-lactating women aged 18–29.9 years. Micronutrient adequacy using the nutrient density method assumes household members are meeting their energy requirements. **If energy requirements are not being met, adequacy may be overestimated,** though the problem in that case is insufficient food intake and not nutrient composition of the diet.

In Zambia, we found somewhat higher estimates of household inadequate micronutrient density compared to the estimates of apparent intake per AFE, and in some cases much higher estimates of nutrient density inadequacy in urban areas and higher socioeconomic strata compared with the corresponding prevalence results based on apparent intake per AFE. In some cases, we also found that rural households had a lower prevalence of micronutrient inadequacy with the nutrient density method, compared to the micronutrient density of the diet in urban households. In both rural and urban areas, in some cases lower socioeconomic groups had lower micronutrient inadequacy based on nutrient density compared to higher socioeconomic groups.

We think this paradox is due to the Zambia LCMS survey including questions about household acquisition of food rather than consumption. We assumed that family members consumed anything they reported purchasing in the recall period in that same period. Median energy intake for the lowest two rural socioeconomic strata showed apparent energy intake below 2,100 kilocalories per day, the assumed requirement for the reference woman 18–29.9 years of age, but above that amount for higher socioeconomic strata, with the highest urban socioeconomic stratum having a median apparent energy intake almost 2.7 times the reference value.

Given the 2015 Zambia LCMS food acquisition data, it may be **more appropriate to consider the energy as "energy available" in the household** during the recall period, rather than consumed. For rural households, the lower prevalence of micronutrient inadequacy with the nutrient density method may be a result of low apparent energy availability observed in rural areas. Urban households, however, appear to have micronutrient intakes that are not proportional to the high household energy availability. Discussing the results with the stakeholder group is critical.

The 2015 LCMS also **lacked conversion factors for converting non-standard units of measure** reported in the data, such as "pile," "bunch," "heap," or "pail" to grams. We borrowed some conversion factors from Malawi and conducted some conversions using price per gram and total price to determine the amount apparently consumed. This may have introduced error in estimated quantities of food purchased and may also contribute to some of the differences seen between the AFE and nutrient density approaches, especially if more non-standard units of measure are common in either rural or urban areas, or households of different socioeconomic strata. Standardized collection of conversion factors would be very useful in all household consumption and expenditure surveys like the LCMS.

Lesson learned: When using the nutrient density method, more clarification is needed on interpretation and application of the results to inform LSFF, particularly when household surveys ask about food "acquisition" rather than "consumption" and some strata have disproportionately high or low energy availability. It would be useful to **standardize collection of household food consumption data across surveys to better inform LSFF programming**. Discussing and interpreting the results with the country stakeholder group is critical.

Challenge: Micronutrients Analyzed in the Cost of the Diet and the Fortification Modeling

We modeled the contribution of fortification to micronutrient adequacy for nine micronutrients: vitamin A, thiamin, riboflavin, niacin, vitamin B6, folate, vitamin B12, iron, and zinc. We also modeled the cost of a nutrient adequate diet without and with LSFF using the Save the Children Cost of the Diet software (Save the Children UK 2018). However, the Cost of the Diet software analyzes the adequacy of 13 micronutrients. In addition to the nine micronutrients mentioned above, the Cost of the Diet software also analyzes the adequacy of vitamin C, calcium, pantothenic acid (vitamin B5), and magnesium.

Our challenge was that **any nutrients that the Cost of the Diet software meets at 100 percent of the requirement or less can drive up the overall diet cost**. We were concerned that we were not seeing the full potential of LSFF on the cost of an adequate diet because of the additional micronutrients analyzed in the Cost of the Diet software that we did not model for LSFF. We could reduce the requirement for vitamin C and calcium in the Cost of the Diet software to 1 percent of the requirement. However, the software prevented us from making the same change for pantothenic acid and magnesium. The Cost of the Diet analysis for Zambia showed that vitamin C and magnesium were not limiting micronutrients, but calcium and pantothenic acid were limiting micronutrients. We analyzed the cost of the diet without and with LSFF and reducing vitamin C and calcium requirements to one percent of the requirement, but we did not see a significant change in the cost and affordability of the diet without and with LSFF compared to including vitamin C and calcium, so we decided to show the Cost of the Diet results for all 13 micronutrients as originally planned. However, given pantothenic acid was a limiting micronutrient not considered under fortification, the cost of the diet could be even less, and affordability might improve if we could model the cost of the diet without pantothenic acid. The World Food Program is developing a new software, Environment, Nutrition, and Health Analytics for National, Consumer, and Emergency Diets (ENHANCE), that may allow for more flexibility in modeling specific micronutrients.

Generally, however, the cost and affordability of the nutrient adequate diet was not very different without and with LSFF, partly because the cost of the fortified food is modeled at a slightly higher cost, an increase of 2 percent, compared to the unfortified version. The Cost of the Diet analysis may demonstrate that the additional cost of a fortified food would not be a great barrier to consumption, if the fortified food were available to households. The stakeholder group is an excellent source of feedback on these types of results.

Lesson learned: Modeling only the micronutrients included in the fortification modeling could potentially enable a more accurate comparison of the diet cost without and with LSFF. The cost of the fortified diet may then be less than that of the unfortified diet.

Conclusions

Our experience piloting the needs assessment and design methodology to inform LSFF programming in Nigeria and Zambia provided opportunities to learn from several of our challenges and to share our learning with a broader audience through this document in our methodology series. Most of our learning was technical in a nature, focused on aspects of our pilot related to needs assessment and modeling, including modeling the contribution of LSFF to micronutrient adequacy, as well as modeling the cost and affordability of the diet without and with LSFF. Our learning will help other teams to avoid pitfalls and overcome challenges similar to those that we faced. Overall, one of our most important learnings was the importance of the country stakeholder groups, and to ensure breadth and depth of stakeholder engagement.

References

Alaofè, Halimatou, Lindsay Kohler, Douglas Taren, Musonda J. Mofu, Justin Chileshe, and Ngandwe Kalungwana. 2014. "Zambia Food Consumption and Micronutrient Status Survey Report." National Food and Nutrition Commission, TDRC Zambia, UNICEF, and University of Arizona. Accessed September 15, 2022. https://www.nfnc.org.zm/download/zambia-food-consumption-and-micronutrient-status-survey-2014.

Anjorin, Olufolakemi, Oluchi Okpala, and Olutayo Adeyemi. 2019. "Coordinating Nigeria's Micronutrient Deficiency Control Programs is Necessary to Prevent Deficiencies and Toxicity Risks." *Annals of the New York Academy of Sciences* June, 1446(1):153–169. https://doi.org/10.1111/nyas.14055.

Allen, Lindsey H., Alicia L. Carriquiry, and Suzanne P. Murphy. 2020. "Perspective: Proposed Harmonized Nutrient Reference Values for Populations." *Advances in Nutrition* 11(3): 469–83. https://doi.org/10.1093/advances/nmz096.

Central Statistical Office. 2016. "2015 Living Conditions Monitoring Survey Report. Republic of Zambia." Accessed August 3, 2022. https://rise.esmap.org/data/files/library/zambia/Documents/Clean%20Cooking/Zambia_LCMS%202015.pdf.

FAO (Food and Agriculture Organization)/INFOODS (International Network of Food Data Systems). 2012. *Guidelines for Food Matching*. Version 1.2. Rome: FAO.

FGN (Federal Government of Nigeria) and the IITA (International Institute of Tropical Agriculture). 2022. *National Food Consumption and Micronutrient Survey 2021: Preliminary Report*. Abuja and Ibadan, Nigeria: FGN and IITA. https://cgspace.cgiar.org/handle/10568/125113.

GAIN (Global Alliance for Improved Nutrition). 2021. "Market Level Assessment of the Fortification Status of Mandatory Food Vehicles in Nigeria". Unpublished report, April 27, 2023

GAIN (Global Alliance for Improved Nutrition). 2023. "GAIN Zambia Food Supply Data Desk Review 2023." Unpublished data set, May 11, 2023.

Harris, Jody, Scott Drimieb, Terry Roopnarainec, and Namukolo Covica. 2017. "From Coherence towards Commitment: Changes and Challenges in Zambia's Nutrition Policy Environment." *Global Food Security,* 13 (June 2017):49–56. https://doi.org/10.1016/j.gfs.2017.02.006.

MAFOODS (Malawi Food Composition Database). 2019. "Malawian Food Composition Table. 1st Edition." Accessed January 9, 2024. https://dl.tufts.edu/concern/pdfs/d217r336d.

Mofu, Musonda and Justin Chileshe. 2022. "Preliminary Results of the 2020 Zambia Food Consumption and Micronutrient Status Survey". Presented at the Zambian National Food Systems Dialogue Meeting, Lusaka, Zambia, September 13, 2022.

NBS (National Bureau of Statistics) 2020. "Nigeria Living Standards Survey." Accessed November 30, 2023. https://microdata.worldbank.org/index.php/catalog/3827.

NFNC (National Food and Nutrition Commission). 2009. "Zambia Food Composition Table." 4th Edition. Accessed August 2, 2022. https://www.nfnc.org.zm/download/zambia-food-composition-tables-4th-edition/.

NFNC (National Food and Nutrition Commission). 2012. "Iodine Deficiency Disorders Impact Survey 2011 Report." Accessed August 2, 2022. https://www.nfnc.org.zm/download/iodine-deficiency-survey-report-2012/.

Save the Children UK. 2018. *The Cost of Diet Tool (CotD)*. London: Save the Children. https://www.heacod.org/en-gb/Pages/AboutCotD.aspx.

Sunley, Nigel, Jonathan Barnow, Christine McCurdy, and Tanya Kynadi. 2023. "Methodology to Identify Opportunities for Engaging the Food Industry on Large-Scale Food Fortification: Guidance to Support USAID's LSFF Programming Guide Results Framework." USAID Center for Nutrition. Prepared by TechnoServe for the Feed the Future Market Systems and Partnerships (MSP) Activity, DAI. Accessed January 11, 2024. https://agrilinks.org/sites/default/files/media/file/Large-Scale%20Food%20Fortification-A%20Methodology%20to%20Identify%20Opportunities%20to%20Engage%20the%20Food%20Industry.pdf.

University of Minnesota. 2023. "Nutrition Coordinating Center: NDSR Software". Accessed January 10, 2024. https://www.ncc.umn.edu/products/.

USAID (U.S. Agency for International Development. 2022. *Large-Scale Food Fortification Programming Guide*. Washington, D.C: United States Agency for International Development. https://agrilinks.org/sites/default/files/media/file/LSFF%20Programming%20Guide_final508.pdf

USDA (U.S. Department of Agriculture). 2023. "FoodData Central Download Data." Accessed January 10, 2023. https://fdc.nal.usda.gov/download-datasets.html.

Vincent, Anna, Fernanda Grande, Ella Compaoré, George Amponsah Annor, Paulina S. Addy, Lilian Chinelo Aburime, Djoufouna Ahmed, et al. 2020. *FAO/INFOODS Food Composition Table for Western Africa (2019): User Guide & Condensed Food Composition Table.* FAO: Rome. https://www.fao.org/3/ca7779b/CA7779B.PDF.

USAID ADVANCING NUTRITION

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