



## REPORT

# IDENTIFYING POTENTIAL NEW FOOD VEHICLES FOR FORTIFICATION IN WEST AFRICA

**MARCH 2018**

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## Summary

Large-scale food fortification is among the most sustainable medium-to-long-term strategies to combat vitamin and mineral deficiencies and one of the most cost-effective public health strategies when implemented through centralized and reasonably developed food industries, and with adequate enforcement. Oil and cereal grain fortification is common throughout West Africa; however, the impact on public health may be insufficient if the current diet (local and fortified foods) does not meaningfully contribute towards meeting the dietary needs for some essential nutrients and/or the coverage of existing fortification programs excludes certain population groups, information which has not been accurately quantified across many West African countries.

In an effort to explore the potential of new food vehicles for large-scale food fortification in West Africa, the Global Alliance for Improved Nutrition (GAIN) took advantage of two Fortification Assessment Coverage Toolkit (FACT) surveys conducted in West Africa (Burkina Faso and Nigeria) that measured quality, coverage and/or consumption of mandatorily fortified foods, for exploring the potential of other industry-manufactured foods for fortification. The new candidate food vehicles for fortification were analyzed based on their market penetration, industry/trade production patterns, and consumption patterns. In Burkina Faso, the presence of brands and producers of rice, tomato paste, bouillon cubes and maize flour were assessed in select urban market hubs across the country. In Ebonyi and Sokoto states in Nigeria, household level coverage and consumption patterns of bouillon cube, tomato paste, and rice were assessed. Additionally, GAIN and the Food Fortification Initiative (FFI) undertook an analysis of the feasibility and potential coverage of fortified rice in the Africa rice supply chain to identify rice fortification opportunities (both domestic and import market) in 19 countries in Africa, including Nigeria.

In Burkina Faso, the results revealed that rice, tomato paste, and bouillon cubes are widely available across all regions of the country, although over 90% of the available brands are imported. In Nigeria, all three foods had high coverage in a fortifiable form; in Ebonyi (100%, 95% and 83%, respectively) and to a lesser extent in Sokoto (99%, 45% and 40%, respectively). Furthermore, in terms of consumption patterns, women of reproductive age in Ebonyi apparently consumed 2 g/day of fortifiable bouillon cube, 27 g/day of fortifiable tomato paste, and 80 g/day of fortifiable rice. In Sokoto, these figures were 3 g/day of fortifiable bouillon cube, 8 g/day of fortifiable tomato paste, and 97 g/day of fortifiable rice. Finally, the supply chain analysis of rice revealed that nearly one third of the 37 million metric tons (MT) of rice that is globally traded each year is exported to Africa. Urban areas in West Africa consume more imported rice than domestic and, in many countries, it remains the predominate source of rice while the current feasibility of domestic fortified rice production in these countries is limited.

In summary, rice, tomato paste, and bouillon cubes may be good potential candidates as vehicles for fortification in both Burkina Faso and Nigeria given their high availability, household coverage and consumption in potentially fortifiable forms. That said, given the reliance on imported products, expanding the fortification mandates to include them would only be worthwhile if there is strong monitoring and enforcement at customs/border levels to ensure that only appropriately fortified foods are imported. If mandates are not expanded and a voluntary fortification approach is pursued for these vehicles, evidence indicates that both the sustainability and the public health impact may be limited.

Before adding new food vehicle to the fortification program further research is needed to assess the nutrient contribution from fortified foods as well as the total intake of the nutrient from all dietary sources to ascertain the extent to which the nutrient gap in the diet could be filled through current fortification efforts. If these analyses reveal that the current program could meaningfully contribute towards filling the nutrient gaps then it may be worthwhile to consolidate efforts to improve the compliance of producers of those food vehicles rather than add new food vehicles. Alternatively, if the current food vehicles do not have the potential to fill the actual nutrient gap or the feasibility to significantly improve compliance among producers is limited then consideration of these new food vehicles may be warranted. In this case, additional research would also be needed to confirm their coverage and utilization in other areas of the country as well as their market share, value chains, and, for bouillon cubes, possibilities of excessive salt consumption.

## 1. Introduction

Fortification of industry-manufactured, and widely distributed and consumed foods with micronutrients (i.e. large-scale food fortification) has the potential to improve the nutritional status of a large proportion of the population (WHO & FAO 2006) and neither requires changes in dietary patterns nor individual decisions for consumption (WHO et al. 2009). Large-scale food fortification is among the most sustainable medium-to-long-term strategies to combat vitamin and mineral deficiencies and one of the most cost-effective public health strategies when implemented through centralized and reasonably developed food industries, and accompanied with a reliable enforcement mechanism.

Africa is currently contributing to the global momentum for oil and cereal grain fortification. In 2004, only two countries (South Africa and Nigeria) had legislation that required fortification of industrially milled wheat flour. Now, 25 countries have such legislation, and seven of those countries also require fortification of industrially milled maize flour. In the 12 West African countries that have mandatory or voluntary wheat flour fortification<sup>1</sup> (FFI 2014), the impact on public health in some of these countries may be insufficient because the population may not consume wheat flour in sufficient quantities to deliver meaningful amounts of micronutrients. In West Africa, alternative foods may be needed to complement the delivery of nutrients through wheat flour. For example, in Ghana, 51 grams of wheat flour are available per person per day, compared to 94 grams of rice (FAO 2011); therefore, rice fortification may have the potential to improve nutrition by complementing the contribution of fortified wheat flour. New vehicles for food fortification may also be advantageous in certain circumstances: 1) when the current diet (local and fortified foods) does not cover the dietary needs for some essential nutrients; and 2) if coverage of existing fortification programs excludes certain population groups. In all cases, the population level impact depends on the proportion of the population that has access to these food vehicles and how much they consume, information which has not been accurately quantified across many West African countries for rice and other food vehicles that may have high potential for impact nutrient intakes if fortified.

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<sup>1</sup> The countries are: Benin, Burkina Faso, Cape Verde, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal and Sierra Leone.

## 2. Objectives

The main objective of this report was to explore the potential of new food vehicles for large-scale food fortification in West Africa.

Specific objectives of the report were:

1. To assess the presence of brands and producers of potentially fortifiable food vehicles (i.e. bouillon cubes, tomato paste, rice, and maize flour) across select market hubs in Burkina Faso;
2. To assess the coverage of potentially fortifiable food vehicles (i.e. bouillon cubes, tomato paste, and rice) among households, and utilization of these foods among children (less than five years of age) and women of reproductive age (15 to 49 years), respectively, in two Nigerian states (Ebonyi and Sokoto); and
3. To assess the feasibility and potential coverage of fortified rice in the Africa rice supply chain to identify rice fortification opportunities (both domestic and import market) in Africa.

For objectives 1 and 2, primary data were collected as part of two Fortification Assessment Coverage Toolkit (FACT) surveys conducted in West Africa that measured quality, coverage and/or consumption of fortified foods implemented by the Global Alliance for Improved Nutrition (GAIN). For objective 3, secondary data from a previously conducted assessment that identified rice fortification opportunities in 19 countries in Africa implemented by GAIN and the Food Fortification Initiative (FFI) were used.

## 3. Methods

### 3.1 BURKINA FASO SURVEY

#### 3.1.1 Study design and selection of market sites

A cross-sectional market survey was conducted by GAIN with support from Helen Keller International (HKI) and in collaboration with the Ministry of Health (MOH) Nutrition Directorate and the Agence Burkinabè de Normalisation, de la Métrologie et de la Qualité (ABNORM) in Burkina Faso. The survey used the FACT market survey methodology. Detailed survey methods and results are presented elsewhere (GAIN 2018) and summarized as follows.

Eight market hubs (Banfora, Bobo-Dioulasso, Dédougou, Ouagadougou, Kaya, Ouragye, Tenkodogo, and Fad N’Gourma) were strategically selected based on the following criteria: population size and density,

geography and road networks taking into consideration security and logistics. Market hubs located in areas of high population density and at intersection of roads used to dispatch the food vehicles from production or import sites towards populated areas were prioritized. Figure 1 shows the location of all markets hubs selected.



**Figure 1. Map of selected market hubs and roads in Burkina Faso**

In each market hub, up to three main marketplaces were selected, with a marketplace being defined as a large concentration of all types of retail outlets in a large geographic area within the market hub that allows buyers and sellers of the food vehicle to interact. Within each marketplace, the teams aimed to visit at least three retail outlets of each type (i.e. retail shop, supermarket, wholesaler and bakery) that sold at least one of the food vehicles of interest were visited.

### **3.1.2 Data collection**

Upon arrival in a market hub, three main marketplaces were identified. In each marketplace, retail outlets that sold at least one of the food vehicles of interest were identified. In each retail outlet visited, the name, location, and type of retail outlet were recorded along with information on the available brands per food

vehicle, including the producer name and address, the distributor/importer name and address, and the packaging types and sizes for sale.

### **3.1.3 Ethical considerations and survey administration**

Approvals were obtained from the Direction Générale de la Santé, Direction de la Nutrition. Data were collected by two trained data collectors under the supervision of GAIN and ABNORM staff. All survey instruments were contextualized and adapted to the local context then translated into French. Survey instruments were pilot-tested prior to implementation to finalize language, wording, and flow of questions and response options. Data were collected on paper forms, which were reviewed daily by supervisors for completeness and correctness. All data collected as part of this survey are stored securely within the GAIN office, are only available to authorized individuals for analytical purposes and are handled in accordance with data protection best practices.

## **3.2 NIGERIA SURVEY**

### **3.2.1 Survey design and target population**

A survey in which households were selected using cross-sectional, multi-stage, cluster sampling and data were collected using the FACT methodology was conducted by GAIN and Oxford Policy Management (OPM) in collaboration with the Federal Ministry of Health in two states of Nigeria, Ebonyi and Sokoto. Detailed survey methods and results are presented elsewhere (GAIN & OPM, 2018) and summarized as follows.

The target population was children (under five years of age) and women of reproductive age (WRA) (15–49 years old) as these two groups are among those most at risk of micronutrient deficiencies. In each state, 15 households were selected in 41 enumeration areas. Within each household, one child less than five years of age was randomly selected and his/her caregiver was invited to participate in the survey.

### **3.2.2 Data collection**

One household questionnaire was administered per household. First, the household roster was administered to the household member most knowledgeable about the household. Then the primary caregiver of the selected child under five was then asked to complete the remainder of the household questionnaire. Information on household demographic and socio-economic characteristics was collected along with information on household level coverage and consumption patterns (using the adult male equivalent method) of fortifiable foods, including rice, tomato paste and bouillon cubes.

### **3.2.3 Ethical considerations and survey administration**

Approvals were obtained from the National Health Research Ethics Committee of Nigeria. Data were collected by trained data collectors under the supervision of OPM and GAIN staff. All survey instruments were contextualized and adapted to the local context then translated into local languages. Survey instruments were pilot-tested prior to implementation to finalize language, wording, and flow of questions and response options. Data were collected on tablets, electronically through CAPI software, which enabled automated live data checks during the implementation of the household interview. Extensive validations and cross-checks were programmed into the CAPI software to reduce errors and inaccuracies during the household interview. All data collected as part of this survey are stored securely within the OPM and GAIN offices, are only available to authorized individuals for analytical purposes and are handled in accordance with data protection best practices.

## **3.3 SUPPLY CHAIN ANALYSIS OF RICE IN AFRICA**

### **3.3.1 Study design**

GAIN and the Food Fortification Initiative (FFI) undertook an analysis of the feasibility and potential coverage of fortified rice in the Africa rice supply chain to identify rice fortification opportunities (both domestic and import market) in 19 countries in Africa. Detailed methods and results are published elsewhere (FFI & GAIN 2016a) and summarized as follows.

### **3.3.2 Data collection**

Primary and secondary data were collected on rice milling industries (both domestic and import markets) in 19 countries in Africa. Primary data were collected in 13 priority countries: Benin, Gambia, Ghana, Guinea, Guinea Bissau, Côte d'Ivoire, Liberia, Mali, Madagascar, Nigeria, Senegal, Sierra Leone, and Comoros by a consultant. Secondary data sources, including, UN COMTRADE, FAO, USDA and rice exported association websites for basic country data, including bilateral trade flow data, were used to collect additional information on the 13 initial countries as well as six additional countries, i.e. Cabo Verde, Mauritania, Djibouti, Egypt, Gabon, Mauritius.

## 4. Results

### 4.1 BURKINA FASO SURVEY

In total, 255 retail outlets were visited in the eight market hubs selected for the market assessment. The results revealed that rice, tomato paste, and bouillon cubes are widely available across all regions of the country, although over 90% of the available brands are imported. In summary, 60 brands of bouillon cube were identified that were produced by 27 companies across 10 countries, with only one (3.6%) being locally produced. For tomato paste, 76 brands were identified from 11 countries, with only three brands (3.9%) being locally produced. For rice, 136 brands were identified from 10 countries, with only 13 (10%) being locally produced. For maize flour, 35 brands were identified from three countries with 33 brands (94.3%) being locally produced. The imported brands of bouillon cubes are mainly from Europe and Senegal, tomato paste from China, and rice from Asia (Thailand, Vietnam and India). In contrast, maize flour was predominantly locally produced but, according to the labelling, marketed as a specialty product targeting people with diabetes and young children.

The following profiles present general information for each food vehicle, such as the number of brands present in the markets, the breakdown of types, packaging characteristics, and the distribution across the market hubs, as well as specific information of interest per food vehicle related to disaggregation by origin of production and/or importation versus local production.

## A Profile of Burkina Faso's Bouillon Cube Market

### Presence

Total companies: 27

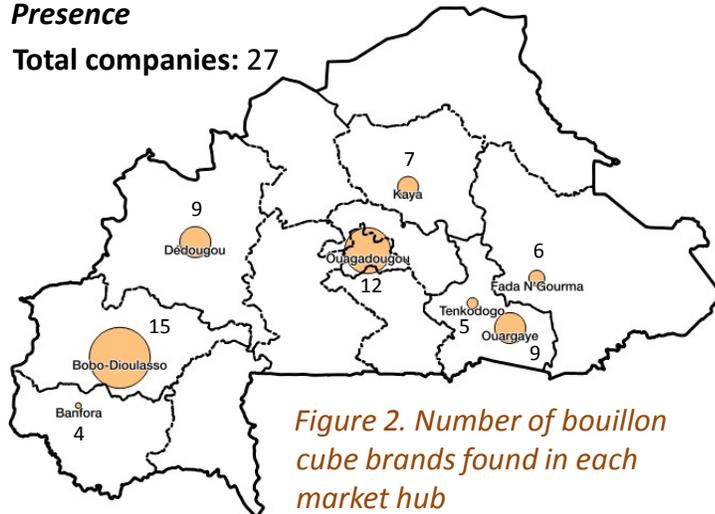


Figure 2. Number of bouillon cube brands found in each market hub

Production Origin	N	%
Burkina Faso	1	3.6
Ghana	2	7.1
Mali	1	3.6
Niger	1	3.6
Nigeria	1	3.6
Senegal	5	17.9
Tunisia	1	3.6
France	6	21.4
Spain	3	10.7
China	3	10.7
Unknown	4	14.3

General

While 60 unique brands were identified in the market hubs, these were produced by 27 companies. Two large companies produced 8 unique brands each, 1 company produced 5 brands, 1 company produced 4 brands, 4 companies produced 2 brands each, 4 companies produced 3 brands each, and the remaining 15 companies in the market produced just 1 brand each. Only one of these companies was Burkinabé.

### Production origin

\*Of the 27 companies, just one is produced in 2 different countries, thus the count by production origin is 28, not 27. All but 1 are imported. While the country of production could not be identified for 4 companies, 12 companies (48%) were based in African nations (Burkina Faso, Ghana, Mali, Niger, Nigeria, Senegal and Tunisia), 9 were European (from France or Spain), and 3 were Chinese.

### Outlets

Most bouillon cube companies were observed for sale in small retail shops (78% of the companies) and in supermarkets (52%). Only 15% of the companies were sold in wholesale shops. For those companies that produce in African nations, all (100% of companies) sold their brands in small retail shops, while ½ (50%) sold in supermarkets. Companies from Europe generally sold more in supermarkets (78% of European bouillon cube companies) compared to small retail shops (44%).

Four of the companies had spread their products widely across the country and were found in 7-8 of the market hubs all market hubs. The majority of the companies (21, 78%) were found in just 1-2 hubs.

### Packaging trends

All companies sold their products as cubes packaged in boxes of different quantities (4 cubes up to 64 cubes). Boxes of 60 cubes were a popular size for companies – 52% of companies sold in that size. A few also sold their products in plastic sachets.

## A Profile of Burkina Faso's Tomato Paste Market

General

Production Origin	N	%
Burkina Faso	3	3.9
China	37	48.7
Italy	8	10.5
Ghana	2	2.6
Malaysia	1	1.3
France	1	1.3
Turkey	1	1.3
Niger	1	1.3
Senegal	1	1.3
Tunisia	1	1.3
UAE	1	1.3
Unknown	19	25.0

### Presence

Total brands: 76

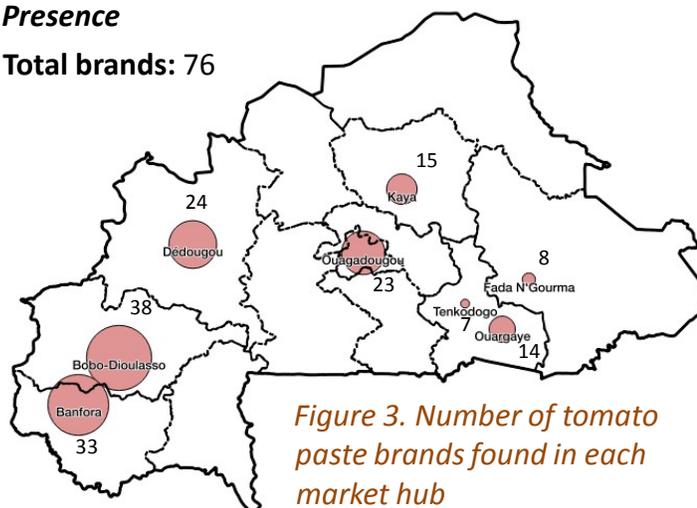


Figure 3. Number of tomato paste brands found in each market hub

### Production origin

The majority of tomato paste brands are imported from China (37 brands, 49%), with the Italian brands being second (8 brands, 11%). Only 3 brands were locally produced (4%). The 3 locally produced brands were found in the western market hubs.

### Outlets & market dispersion

A high proportion of brands are found in small retail shops (80%) and in supermarkets (57% of brands). Wholesalers stock a narrower range of brands (33% of brands represented). As can be seen in the map, a larger proportion of brands were found out in western market hubs and Ouagadougou compared to the eastern market hubs: in total 50% of observed brands were seen in Bobo-Dioulasso, 44% seen in Banfora, 32% were seen in Dé Dougou, and 30% in Ouagadougou. By comparison, 20% were seen in Kaya, 18% in Ourgaye, 11% in Fada-Ngourma, and 9% in Tenkodogo.

### Packaging trends

Most of the brands are available in tin cans of 1 to 2 packaging sizes: 29 brands (38%) are available in just one packaging size, while 32 brands (42%) are available in 2 different packaging sizes and 13 brands (17%) are available 3 or more packaging sizes. The tin cans vary in size/weight from 56g to 2.2kg, with the most commonly sold sizes being 2.2kg cans (54% of brands are sold in this size), 400g cans (34% of brands), 210g (26% of brands), and 70g cans (49% of brands sold in this size). Brands produced in Africa (Burkina Faso, Ghana, Niger, Senegal, and Tunisia), tend to come in 2.2kg, 210g, and/or 70g; brands from China tend to come in the same as well as in 400g cans, while brands from Europe (mostly Italy but also France and Turkey) tend to come in a wider assortment of sizes inclusive of those same sizes mentioned above, as well as 1 kg, 880g, 800g, 600g, 440g, 340g, 220g, and 170g.

## A Profile of Burkina Faso's Rice Market

### Presence

Total brands: 136

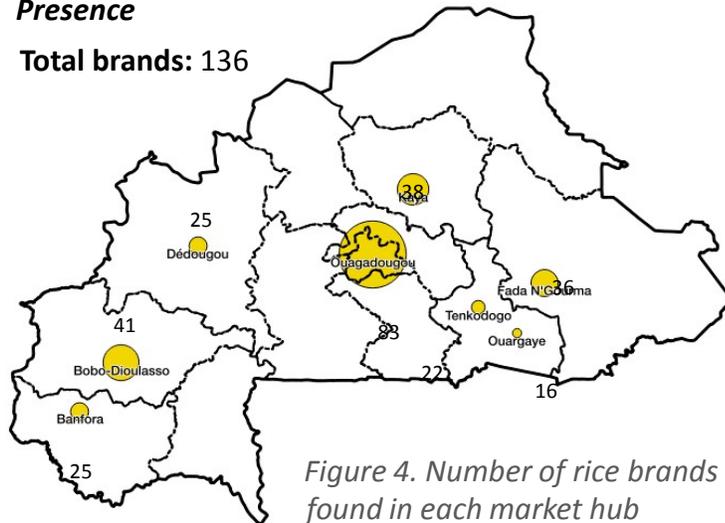


Figure 4. Number of rice brands found in each market hub

### Production origin of brands

	N	%
Burkina Faso	13	9.6
Thailand	40	29.4
Vietnam	18	13.2
Myanmar	4	2.9
India	34	25.0
Pakistan	2	1.5
Italy	2	1.5
USA	1	0.7
Nigeria	1	0.7
Algeria	1	0.7
Unknown	20	14.7

General

### Imported

N = 123 brands (90%)

#### Type

The majority of imported rice brands are sold as whole grain (62%). Approximately 16% are sold as broken rice, almost all of which comes from Southeast Asian countries. Parboiled varieties, on the other hand, come mostly from Asian (India, Pakistan) and African (Nigeria, Algeria) countries.

#### Outlets & market dispersion

The majority of the imported rice brands were found in supermarkets (73%), while closer to ½ the imported rice brands were seen in wholesale shops (47%) and 59% were found in small retail shops. Most brands (85%) are found in 3 or fewer market hubs (14% in 3 hubs each, 31% in 2 hubs each, and 41% in 1 hub each). Of the remaining 15% of brands, 8 brands (7%) are seen in 4 hubs each, 4 brands (3%) in 6 hubs each, and 4 brands in 5 hubs and in 7 hubs respectively.

#### Packaging trends

Most of the imported brands (61%) were available in 50kg PET sacs. The next most common sizes seen were 25kg PET sacs (33%) and 5kg sacs (38%). Approximately 23% were sold in either 1kg or 900g plastic bags.

### Local

N = 13 brands (10%)

#### Type

Most of the locally produced rice brands are sold as whole grain (7 of the 13 brands), while 4 are parboiled and 2 had no indication of type on the packaging.

#### Outlets & market dispersion

Similarly to imported brands, local brands were mostly found in supermarkets (10 of the 13 brands, 77%). Only 3 of the 13 brands were seen in wholesale shops and 1 in small retail shops. Local brands did not have as wide dispersion across markets as imported brands: 1 brand was seen in 4 hubs, 3 brands were seen 2 hubs each, and 9 brands were found in just 1 hub each. No local brands were seen in Banfora, while 8 of the 13 brands were seen in Ouagadougou.

#### Packaging trends

Only 1 of the local brands was seen for sale only in a 1kg plastic bag. The majority (8) were sold in 25kg PET sacs, and 6 of the 13 were sold in 5 kg bags PET sacs.

By Origin of production

## A Profile of Burkina Faso's Maize Flour Market

General

Production Origin	N	%
Burkina Faso	33	94.3
Thailand	1	2.9
Lebanon	1	2.9

### Local Brands

Ouagadougou	27	87.1
Dédougou	2	6.5
Banfora	1	3.2
Kaya	1	3.2

Maize flour is branded as a specialty product targeting people with diabetes and young children.

### Presence

Total brands: 35

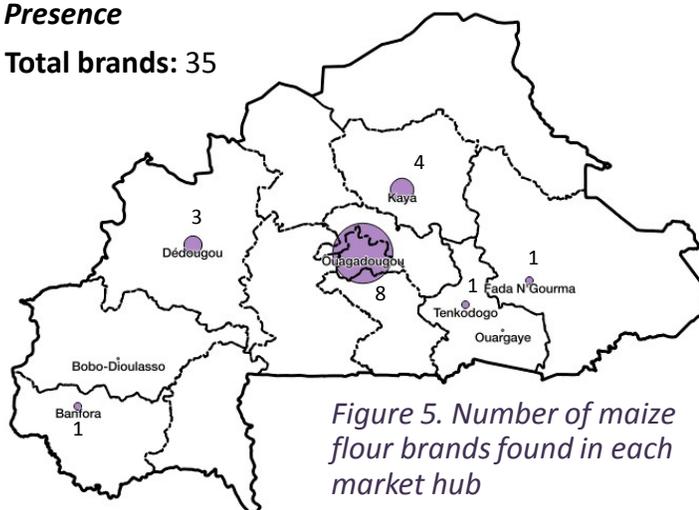


Figure 5. Number of maize flour brands found in each market hub

### Production origin

The majority of maize flour brands are locally produced in Ouagadougou: Of the total 35 brands, 33 were Burkinabé and 27 were produced in Ouagadougou. The remaining two were produced in Dédougou, one in Banfora, and one in Kaya (for 2 local brands, the production site could not be discerned). Of the two imported brands, one is produced in Thailand and one in Lebanon.

### Outlets & market dispersion

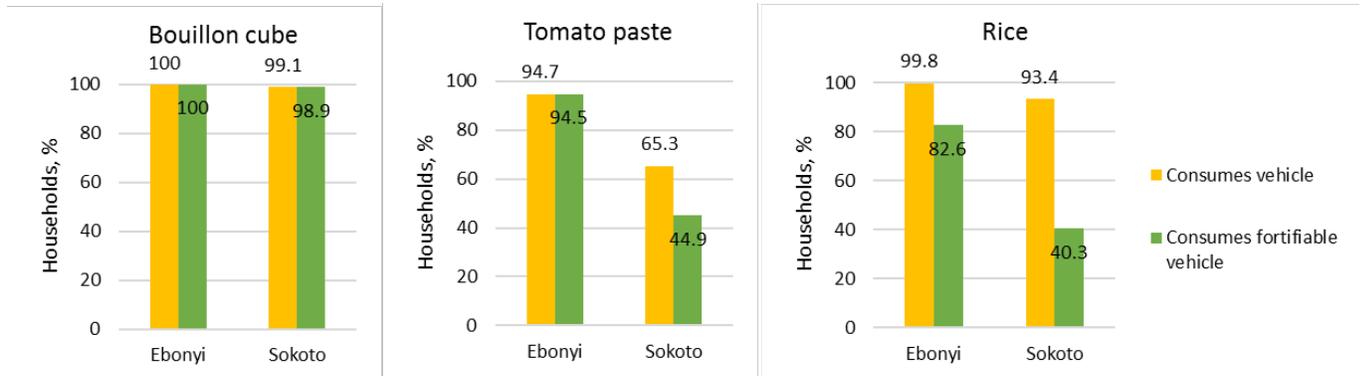
All brands were found only in supermarkets. The majority of brands (33 brands) were also found only in one market hub, with one brand found in 2 hubs and one brand found in 3 hubs. The market for maize flour is highly concentrated in Ouagadougou (28 brands found in the capital) with the rest of the market hubs selling between 1 to 4 brands. No maize flour brands were found in Bobo-Dioulasso or Ouargaye.

### Packaging trends

Most of the brands are available in 1kg plastic sacs (49% of brands), with ¼ of brands (26%) available in 15kg PET sacs. Other observed sizes are bags of 500g, 2kg, 3kg, 4kg, 5kg, 6kg, 9kg, 20kg, and 25kg. The majority of brands (51%) were available in just one size, but 6 brands were found in 2 different sizes and 7 brands were found in 3 different sized packages.

## 4.2 NIGERIA SURVEY

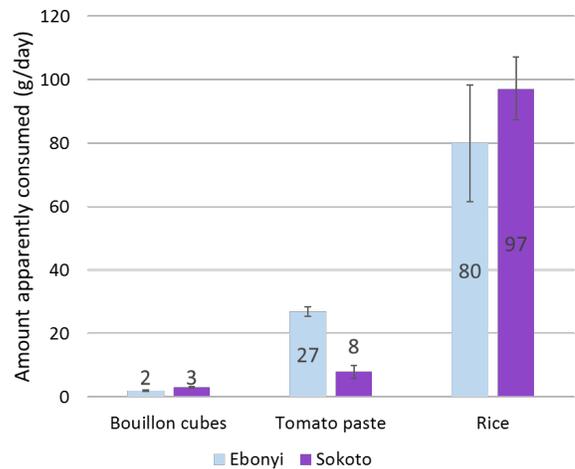
In total, 610 households in Ebonyi and 614 households in Sokoto (of the required 615 in each state) were interviewed. In Ebonyi, there was nearly universal household coverage of bouillon cube, tomato paste, and rice in general (100%, 95%, and 100%, respectively) with similarly high coverage of the fortifiable forms of the food vehicles, i.e. industrially produced, (100%, 95%, and 83%, respectively) (Figure 6). In Sokoto, there was high coverage of bouillon cube and rice (99% and 93%, respectively) with slightly lower coverage of tomato paste (65%) in general. An equal proportion of households consumed bouillon cube in a fortifiable form (99%) while household coverage of fortifiable tomato paste and rice was lower (45% and 40%, respectively) (Figure 6).



**Figure 6. Household coverage of foods and fortifiable foods in Ebonyi and Sokoto, Nigeria**

When household coverage results were disaggregated by various risk factors related to low micronutrient intakes, some differences were revealed. In Sokoto, fewer poor households (i.e. multi-dimensional poverty index  $\geq 0.33$ ) consumed fortifiable rice compared to non-poor households (36% vs. 54%). Similarly, fewer low socio-economic households (i.e. those in the lowest two demographic health survey (DHS) wealth quintiles) compared to high socio-economic households (i.e. those in the highest three DHS wealth quintiles) consumed fortifiable tomato paste (37% vs. 54%) and rice (36% vs. 45%). In Ebonyi, there were no differences between poor vs. non-poor or low vs. high socio-economic households in terms of coverage of these fortifiable foods. These differences are not surprising as the risk of poverty is high in Sokoto (76% of households are poor vs. only 33% in Ebonyi, and 51% of households have low socio-economic status vs. only 28% in Ebonyi). Furthermore, Sokoto is a rice producing state, which in part explains the lower coverage of fortifiable rice among households.

Figure 7 presents the amount of fortifiable foods consumed daily among WRA. In terms of consumption patterns, WRA in Ebonyi apparently consumed 2 g/day of fortifiable bouillon cube, 27 g/day of fortifiable tomato paste, and 80 g/day of fortifiable rice. In Sokoto, these figures were 3 g/day of fortifiable bouillon cube, 8 g/day of fortifiable tomato paste, and 97 g/day of fortifiable rice. There were no significant differences in daily consumption of these fortifiable foods between women from poor vs. non-poor or low vs. high socio-economic households in either state.



**Figure 7. Daily apparent consumption of fortifiable foods among women of reproductive age in Ebonyi and Sokoto, Nigeria**

#### 4.3 SUPPLY CHAIN ANALYSIS OF RICE IN AFRICA

The supply chain analysis of rice revealed that nearly one third of the 37 million MT of rice that is globally traded each year is exported to Africa. Urban areas in West Africa consume more imported rice than domestic and, in many countries, it remains the predominate source of rice. On average, 19 African countries, including several in West Africa, have 75 grams per capita per day of rice available for consumption. The current feasibility of domestic fortified rice production in these countries is limited; therefore, successful rice fortification would require the fortification of imported brands that are coming predominately from countries in Asia. Detailed results are available in the report (FFI & GAIN 2016a) and country profiles can be found on the FFI website.

Of most interest to this report is the Nigeria country profile (FFI & GAIN, 2016b), which revealed that Nigeria is the biggest rice consuming country in Africa (5.1 million MT) and had the greatest number of rice imports (2.1 MMT) and domestics rice production (2.7 million MT) in 2016. However, 80% of the rice consumed is imported and controlled by a limited number of companies (four to five) while only about 12% of local rice is industrially produced and could potentially be fortified with the remainder being produced domestically for home consumption and thus would not be feasible to fortify.

## 5. Key Findings and Recommendations

### 5.1 KEY FINDINGS

The findings of this report provide information on the potential for fortification of new food vehicles in West Africa, particularly in Burkina Faso and Nigeria. In summary, rice, tomato paste, and bouillon cubes may be good potential candidates as vehicles for food in both Burkina Faso and Nigeria given their high availability and household coverage and consumption in potentially fortifiable forms. However, as the majority of those foods are coming from other countries, a food fortification program based on them should be conceptualized as regional and place a major emphasis on a very strong and reliable enforcement mechanism at the importation sites. On the other hand, maize flour in Burkina Faso is not recommended as a vehicle for fortification given its generally low household coverage in a fortifiable form.

Bouillon cubes appear to be the most suitable for establishing large programs with less heterogeneity and therefore potentially easier to manage given the relatively small number of companies producing them in Burkina Faso with about half (48%) coming from West and North Africa and high household coverage in a fortifiable form in Nigeria. A fortified bouillon cube containing iodine and iron has already been released by one large manufacturer in multiple West African countries (Benin, Togo, Cameroon, Côte d'Ivoire, Nigeria, Senegal, Ghana, Niger and Guinea) (Nestlé, 2015). However, information on its coverage and consumption is limited. Further research is needed into the market share and supply chains, both nationally and across other regions/states, and into any potential health implications related to excessive salt consumption, given the success of the salt iodization programs and estimated nutrient intake contributions, in the event the promotion of a fortified bouillon cube increases demand and consumption before specific recommendations can be made. Tomato paste and rice have high potential, although this is compromised by the home-production of these foods in some areas. That said, they also appear more challenging as vehicles for fortification given they are widely produced outside of Africa (over 90% of the available brands are imported). As a result, expanding the fortification programs to include them would only be worthwhile if: 1) foreign producers are willing to fortify the products they are exporting to these countries, and 2) there is strong monitoring and enforcement at customs/border levels to ensure only appropriately fortified foods are imported. Efforts to initiate and/or improve fortification in the countries where these imported products are coming from would likely be necessary given the low level of fortification among imported brands found in the Burkina Faso survey. This may also require an alignment of standards across the main countries supplied with the same products.

That said, the heavy reliance on imported rice that is centrally produced in other regions may actually make rice fortification opportune in many West African countries. For countries with limited internal rice fortification capacity, such as those in West Africa, requiring the fortification of imported rice could be relatively easy if the rice industry in other countries accepts to implement the intervention. However, national production of rice is still important, as demonstrated in the Nigeria survey, therefore further studies are needed to better understand its potential as a fortifiable food source. Mandatory legislation for both imported rice as well as domestically produced rice across the region would be necessary to increase the coverage of fortified rice in West Africa and create the necessary policies requiring rice exporters in the major exporting countries (e.g. Thailand, Vietnam, and India) to fortify their exported rice to the region.

An important limitation to note in these studies is that dietary intake data were not collected. Therefore, while the studies do identify potential food fortification vehicles, they do not provide the evidence that would be needed to design such programs, i.e., which nutrients and at what level specific nutrients should be fortified.

Before adding new food vehicle to a fortification program further research is needed in each country to assess the following three things. First, it is important to assess both the nutrient contribution from fortified foods as well as the total intake of the nutrient from all dietary sources to ascertain the extent to which the nutrient gap in the diet could be filled through current fortification efforts. Second, if these analyses reveal that the current program could meaningfully contribute towards filling the nutrient gaps then it may be worthwhile to consolidate efforts to improve the compliance of producers of those food vehicles rather than adding new food vehicles. Third, if the current food vehicles do not have the potential to fill the actual nutrient gap or the feasibility to significantly improve compliance among producers is limited then consideration of these new food vehicles may be warranted. In this case, additional research would be needed to confirm their coverage and utilization in other areas of the country as well as their market share, value chains, and, for bouillon cubes, possibilities of excessive salt consumption. It is important to underscore these formative steps to avoid inheriting current constraints with any new food vehicles for fortification.

## 5.2 RECOMMENDATIONS

Based on the findings of this report, several priority recommendations can be made:

1. Future research into dietary intake patterns of these food vehicles and the nutrient gap the current fortification programs could fill is needed before new food vehicles are added;
2. Further research into the market share and supply chains for bouillon cube and tomato paste is needed; and
3. Further research into the feasibility of nationally produced rice in countries of interest is needed.

These results will be shared with nutrition stakeholders in Burkina Faso, Nigeria and the region to further guide programming efforts and nutrition policy recommendations.

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