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USAID Advancing Food Fortification Opportunities to Reinforce Diets (USAID AFFORD)

Large-Scale Food Fortification Country Assessment: Haiti

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Acronyms

AFFORD	Advancing Food Fortification Opportunities to Reinforce Diets
AME	Adult Male Equivalent
APMP	Association des Producteurs de Moreaux Peigne
CNSA	Conseil National de Sécurité Alimentaire
DHS	Demographic Health Survey
DOMR	Dominican Republic
ECVMAS	Enquête sur les Conditions de Vie des Ménages Après le Séisme
FAO	Food and Agriculture Organization
FEWS-NET	Famine Early Warning Systems Network
FFI	Food Fortification Initiative
g/day per capita	grams per day per capita
GAIN	Global Alliance for Improved Nutrition
GoH	Government of Haiti
HCES	Household Consumption and Expenditure Survey
HIV/AIDS	Human Immunodeficiency Virus / Acquired Immunodeficiency Syndrome
HUHSA	Huilerie Haïtiennes, S.A.
IU	International Units
IZiNCG	International Zinc Nutrition Consultative Group
LSSF	Large Scale Food Fortification
MARNDR	Ministère de l'Agriculture, des Ressources Naturelles et du Développement Rural
MINIMOD	Micronutrient Intervention Modeling Project
MSPP	Ministère de la Santé Publique et de la Population
MT	Metric Ton
mUIC	Median urinary iodine concentration
NaFeEDTA	Sodium iron (III) ethylenediaminetetraacetate
RANFOSE	Ranfòse Abitid Nitrisyon pou Fè Ogmante Sante
RE	Retinol equivalents
SD	Standard Deviation
UCD	University of California, Davis
UL	Upper tolerable intake levels
USA	United States of America
USAID	United States Agency for International Development
WFP	World Food Programme
WHO	World Health Organization
WRA	Women of reproductive age

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Executive summary

As the poorest country in the Western Hemisphere, the nutrition situation in Haiti is complex, spanning micronutrient deficiencies, as well as under- and over-nutrition, and non-communicable diseases. In recent years, natural disasters, political instability, the COVID-19 pandemic, and violent crime have further exacerbated the nutrition situation in Haiti.

To identify the role that food fortification could play in addressing micronutrient inadequate intake and deficiencies in Haiti, the United States Agency for International Development (USAID) Advancing Food Fortification Opportunities to Reinforcing Diets (AFFORD) undertook an assessment of foods under mandatory fortification - edible oil, salt, and wheat flour - as well as several non-mandated foods - bouillon cubes, rice, pasta, Akamil, and sugar - as potential vehicles for fortification. The assessment aimed to describe the feasibility of fortifying these foods, the current status of food fortification (as of August 2023), the enabling environment for mandatory foods, and the potential public health (dietary) and economic impact. To carry out this assessment, USAID AFFORD conducted a desk review and interviewed 20 government, industry, and development partner stakeholders from June-September 2023.

Key findings from the assessment

Although the 2017 Law on Micronutrient Food Fortification is in place, and identifies three foods that must be mandatorily fortified in Haiti (edible oil, salt, and wheat flour), **there are no standards yet to support the implementation of food fortification**. Draft standards were proposed in 2021 during President Jovenel Moïse's tenure but were never ratified due to competing priorities. As a result, although there are food processors who report to fortify according to the draft standards, without formally approved and adopted standards there are officially no requirements that the food processors must adhere to for fortification, and therefore nothing for government regulatory inspectors to enforce. The existing draft standards also specify unclear or incorrect fortification levels for vitamin A in oil and iodine in salt - if passed as-is, the standards will be confusing for stakeholders to implement.

All wheat flour is industrially milled and can technically be fortified. The majority (60%) of flour in Haiti is produced locally by three millers who are reporting to fortify. However, testing of flour samples found in the marketplace that all three millers are not fortifying all of the flour that is produced - one miller did not have any positive flour samples. The remaining flour is primarily imported from the Dominican Republic (DOMR), where wheat flour fortification is already mandatory. All flour imported from the DOMR was found successfully fortified according to DOMR standards, which specifies higher iron levels than the draft Haitian standard. However, the DOMR adds ferrous fumarate instead of NaFeEDTA as has been proposed for Haiti. As the iron amounts are nearly twice in the DOMR, the nutritional contribution is similar to when using NaFeEDTA. This is a positive finding, as porous borders between the two countries would make it challenging to ensure imported flour is fortified. Local pasta companies are another opportunity to use fortified flour.

The reverse is true for salt, as **60% of the salt market is primarily composed of small-scale, artisanal salt producers**. With only one salt processor, Bon Sel Dayiti (6% market share), who reports fortifying their washed and ground salt and selling to food service, retail, and processed food customers, such as one of Haiti's local bouillon cube manufacturers. The remaining salt (34%) is imported, either as refined salt or coarse salt that can be processed in Haiti. The majority of salt in Haiti (79%), whether locally produced or imported, is not fortified. Only 9% of the salt is estimated to meet the drafted minimum target for iodine. Fortified salt is expected to have low effective coverage.

Given the widespread use of salty condiments such as bouillon cubes, **ensuring that iodized salt is used in processed foods (such as bouillon cubes) is another important avenue for iodine intake**. Bouillon cubes are used extensively and 66% of households report using at least two bouillon cubes per meal, whereas only 8% of households use fortified salt. Ninety percent of bouillon cubes are produced locally by two companies in Haiti. Both report to already use iodized salt (either produced by Bon Sel or imported), which was confirmed by the market assessment. A study conducted in June 2022 in a remote rural area of the Central Plateau found adequate median urinary iodine concentration (mUIC) in both women and school-children, with higher mUIC correlated with higher reported bouillon cube consumption. In the same region, a national survey conducted six years prior found inadequate mUIC. This suggests that iodine status may already be adequate in areas of Haiti, potentially attributable to existing use of iodized salt in bouillon cubes and other locally processed foods using iodized salt. However, no other recent data are available to identify where vulnerable populations may still exist (e.g. in other mountainous areas). Eighty-two percent of the bouillon cubes contained significant amounts of iodine, and 18% did not. Non-fortified bouillon cubes were imported from DOMR and other countries.

Edible oil, rice, and sugar are all predominantly imported, meaning they are industrially milled and thus it would be technically feasible to fortify in the places of origin. However, **ensuring that an imported food is fortified will require a functioning import monitoring system and standards to which importers can adhere to, neither of which currently exist in Haiti.**

Palm oil is the predominant oil used in Haiti (in 2022, ~90% coming from Indonesia, 7% from the DOMR, and the remainder from Malaysia and Colombia) and, followed by soybean oil produced in the DOMR. The market assessment found that while the majority of locally packaged/branded oil was fortified, imported oil from the DOMR and other countries leads to nearly one-third of the total oil in Haiti not being fortified. Cross-border imports of edible oil from the DOMR will be challenging to monitor.

Over 90% of rice is imported from the US, where rice fortification is already mandatory. However, rice fortification standards in the United States were not developed for Haitian dietary needs. The dusting technology used for rice

fortification in the US may also not be appropriate in Haiti if rice is washed prior to cooking or cooked in excess water.

Eighty-five percent of sugar is imported from Honduras, Guatemala, Nicaragua, and Colombia. While the three Central American countries already have domestic mandatory fortification of sugar vitamin A and could export sugar that has been produced under national standards, Colombia does not. Imported sugar packages are not labeled as fortified.

Akamil, a corn and pulse powder blend that was modified from Akasan (a traditional drink) for higher nutritional content, could feasibly be fortified by the single large processor in Haiti. Akamil is primarily sold as a complementary food to humanitarian agencies and targeted to populations with higher dietary needs, such as pregnant women, young children, and persons with Human Immunodeficiency Virus / Acquired Immunodeficiency Syndrome (HIV/AIDS). There are no consumption data available for Akamil to indicate whether the general population would benefit from fortifying Akamil.

Modeled food fortification scenarios for rice, oil, and wheat flour suggest that significant reductions in micronutrient inadequacies could be addressed if fortification were effectively implemented and / or if additional nutrients were added to these vehicles (e.g., vitamin B_{12} to wheat flour)[1]. Several food vehicles are feasible to fortify from a technical standpoint, as they are industrially produced either locally or abroad. However, from an implementation standpoint the enabling environment for mandatory food fortification in Haiti lacks two major elements: approved standards to guide industry fortification and a functional regulatory monitoring system made worse given existing food insecurity and political instability. Without these two elements, large-scale food fortification (LSFF) will depend on the voluntary compliance of private industry, which is very uncertain.

[1] Multiple nutrient fortification of bouillon (with nutrients beyond iodine) could also reduce micronutrient inadequacies and could be a more cost-effective food vehicle than rice in Haiti for many micronutrients if adequate amounts can be added. But at this time the direct fortification of bouillon with multiple micronutrients (compared to the use of iodized salt as an ingredient) is still being explored by researchers from an efficacy standpoint.

Introduction

The United States Agency for International Development (USAID) Mission in Haiti is committed to supporting the Government of Haiti's (GoH) efforts to improve the nutritional status of the Haitian population. USAID/Haiti supports a range of programming approaches to maintaining and improving nutrition outcomes. As one component of its programming, USAID supports large-scale food fortification (LSFF) efforts in Haiti, most recently through the Ranfòse Abitid Nitrisyon pou Fè Ogmante Sante (RANFOSE) project (2017-2024). The RANFOSE project was designed to increase the availability of high-quality, fortified staple foods and expand the local production and importation of fortified foods. The project has supported fortification of wheat flour with iron, folic acid, and other B complex vitamins, edible oils with vitamin A, and salt with iodine.

The end of the RANFOSE project's period of performance offers an opportunity to assess the current status of fortification and support USAID/Haiti to consider options for strengthening their support for LSFF in the country, including exploring opportunities using other food vehicles (e.g. bouillon cubes, Akamil (a cereal-pulse blend), spaghetti noodles, sugar and rice). To this end, USAID/Haiti and USAID/Washington engaged USAID Advanced Food Fortification Opportunities to Reinforce Diets (AFFORD) to assist with the assessment.

Assessment objective

The objective of USAID AFFORD's assessment in Haiti was to determine the status of fortification in select food vehicles (wheat flour, edible oils, salt, and bouillon cubes) through an industry and market assessment. To provide context to the industry and market assessment results, USAID AFFORD conducted a desk review of the dietary implications (e.g., consumption, micronutrient inadequacies) and enabling environment (e.g. policy, standards, monitoring).

To the extent possible, USAID AFFORD used these results to identify options for fortification that USAID/Haiti can take to support the GoH's efforts to strengthen and scale the country's current food fortification system.

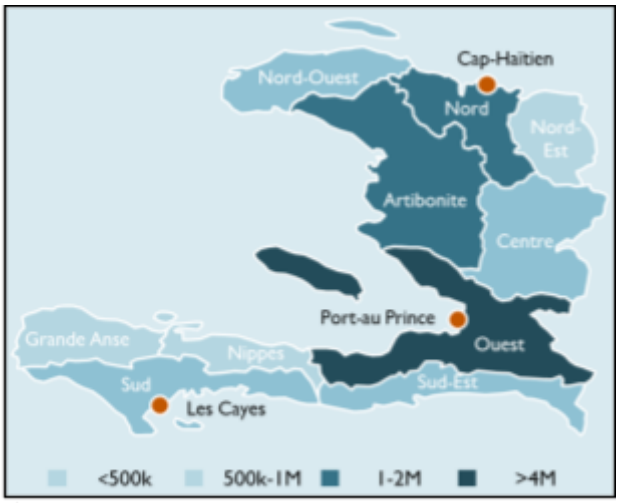
Background

Population

With a population of approximately 12 million people, Haiti has recently surpassed Cuba to become the most populated country in the Caribbean. Between 2002 and 2022, the population of Haiti grew at an average rate of 1.5% per year (World Bank, 2023).

In 2015, the Port-au-Prince metropolitan area was home to approximately 25% of the Haitian population. Around 360,000 people

Figure 1: Population per region, 2015[1]



[1] Institut Haitien de Statistique et d'Informatique

lived in the Cap-Haitien arrondissement, and 350,000 resided in the Les Cayes arrondissement (IHSI, 2015) **(Figure 1).**

Over the past 50 years, there has been a significant increase in the proportion of the population living in urban areas. The share of the urban population rose from 36% in 2000 to 59% in 2022. Approximately 32% of the population in Haiti is below the age of 15 (IHSI, 2015).

Current situation in Haiti

Haiti had not fully recovered from a catastrophic 2010 earthquake, which leveled much of Port au Prince, killed 300,000 people and left 1.3 million homeless (DesRoches et al., 2011). More recently, President Jovenel Moise was assassinated in July 2021 and another earthquake hit in August 2021. The August 2021 earthquake which claimed the lives of over 2,200 people and damaged 130,000 homes (Ministère de la Planification et de la Coopération Externe, 2021).

The country is now facing a range of crises, including:

- **Escalating violence and serious human rights violations:** As of March 15th, 2023, at least 531 people were killed, 300 injured, and 277 kidnapped by gangs since the beginning of the year (ONU, 2023). Reports estimate that 80% of Port-au-Prince, is now under control by armed gangs (ONU, n.d.).
- **Severe food shortages:** As of March 2023, around 65% (6.8 million people) of the population is reportedly experiencing insufficient food consumption. This represents a significant increase from June 2022 when 42% of households faced food shortages (World Food Programme, 2023). In the metropolitan area of Port-au-Prince, the situation varies across neighborhoods. Cité Soleil is the hardest-hit area in the country, with 82% of households experiencing insufficient food consumption, while Carrefour has a rate of 58% (World Food Programme, 2023). Food processors estimate that food consumption has dropped by about 30% compared to before July 2021.
- **Growing cholera outbreak:** A new cholera epidemic began in September 2022, with over 60,000 suspect cases documented and 850 deaths reported as of August 24, 2023 (MSPP, n.d.).

Import dependency

In 2015, more than 50% of the food consumed in Haiti was imported (Schwartz, 2015), and this proportion is likely to have increased further due to recent turmoil. The primary points of entry for imported food are the port of Port-au-Prince and the border with the DOMR, especially in the region near Cap-Haitien. A limited amount of food is produced locally.

Formal and informal markets

The informal market dominates the food distribution channels in Haiti. Around 98% of local products are sold in informal markets, including open-air markets and street vendors. As for imported products, approximately one quarter of them are sold through formal markets, such as supermarkets and registered warehouses (Schwartz, 2015).

The formal system primarily deals with imported products and can be divided into two distinct distribution channels:

- Modern supermarkets that cater to upper-middle-class customers (approximately 10% of the population), mostly located in Port-au-Prince.
- Wholesalers located across the country who supply small shops and individual sellers.

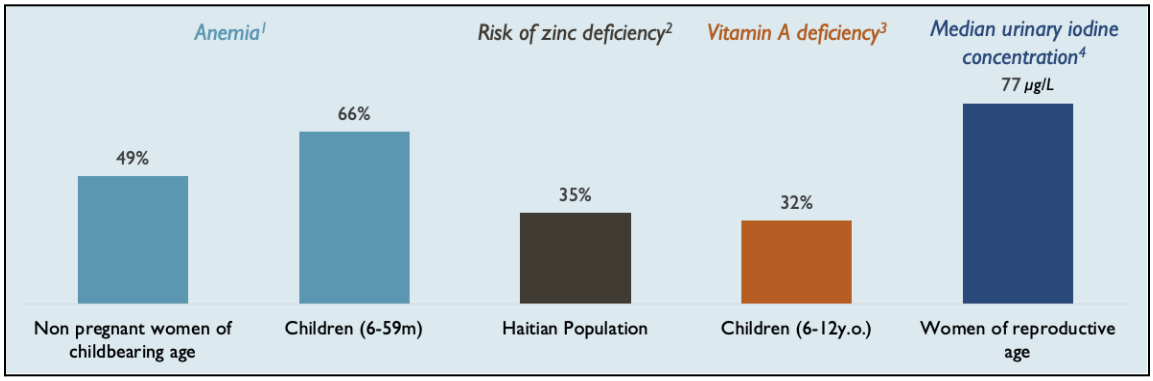
Haiti's informal distribution system relies on a complex rotating system composed of open-air markets that occur on alternating days of the week. Local goods are mostly sold through these markets. Buying and selling in Haiti is predominantly dominated by women. The "revande" are stationary resellers, while the "madan sara" are itinerant traders. Approximately 90% of salt is sold in open-air markets (Schwartz, 2015).

Public health need for LSFF

Micronutrient deficiencies

Nationally representative data on micronutrient deficiency in Haiti is scarce and micronutrient deficiencies have been considered to be high. Most recent data show prevalence of anemia is high, which is an indicator of both inappropriate diet or health status: 49% among non-pregnant women of reproductive age and 66% among children 6-59 months of age. Poor availability of zinc in the food supply suggests a 35% risk of zinc deficiency among the general population. There is also a high prevalence of vitamin A deficiency among children 6-12 years of age (32%) **(Figure 2)**. The most recent 2016-2017 national survey found inadequate median urinary iodine concentration (mUIC) among women of reproductive age (WRA) (77 µg/L) (MSPP, 2018) but more recent subnational data suggests that WRA and school-age children in a remote rural region within the central plateau have adequate mUIC, which was attributed to the use of iodized salt in bouillon cubes (Barloggio et al., 2023).

Figure 2: Latest data on micronutrient deficiencies in Haiti



[1] MSPP, 2018
[2] Wessells and Brown, 2012
[3] Haiti and UNICEF, 2006
[4] MSPP and UNICEF, 2018

Anemia prevalence among WRA and children as reported by the 2016-2017 Demographic Health Survey (DHS) (Haiti DHS, 2016-2017) should be taken with caution due to the different

drivers of anemia outside of inadequate dietary intake and because of the fact that hemoglobin was measured using the HemoCue finger prick method, which has been found to produce overestimated results as compared with venous blood collection.

The consumption of foods rich in certain micronutrients is insufficient. In 2018, 32% of households reported never consuming foods rich in iron, and 29% reported never consuming foods rich in vitamin A (Haiti MSPP, UNICEF, IR-CUSM, 2019).

Overview of LSFF in Haiti

Legislation and Standards

In 2017, the Law on Micronutrient Food Fortification was enacted, mandating the fortification of all salt, edible oil, and wheat flour in Haiti. Although standards were drafted, they were never voted upon due to the political situation in the country **(Table 1)**. Consequently, the situation remains unclear, and fortification is considered by the food industry more as voluntary than mandatory, given the lack of regulatory monitoring.

Table 1: Overview of mandatory legislation and draft fortification levels in Haiti[1]

Food vehicle	Legislation year	Legislation scope	Standards (Draft version)
Salt	2017	All salt	Iodine: 40 ± 10 mg/kg[2]
Oil (edible)	2017	All edible oil	Vitamin A: 5.25 to 6.9 mg RE/kg[3]
Wheat flour	2017	All wheat flour	Iron: 30 (NaFeDTA) mg/kg Folic Acid: 1.5 mg/kg Zinc: 60 mg/kg Vitamin B_1: 5.4 mg/kg Vitamin B_2: 3.6 mg/kg Vitamin B_3: 40 mg/kg

Abbreviations: kg,. kilogram; mg/kg, milligram per kilogram; NaFeDTA, Sodium iron (III) ethylenediaminetetraacetate; RE, Retinol Equivalent

[1] Fortification is mandatory through legislation passed in 2017. However, standards indicating the specific levels that should be adhered to during fortification were not passed; only a draft standard is available, as listed here.

[2] The draft standard mentions this addition as 33.7 to 67.5 mg of KIO_3 per kg.

[3] The draft standard states "The recommended daily intake of vitamin A is 28 mg of retinol palmitate per kg of vegetable oil, which gives an included fortification rate between 17.5 IU and 23 IU of retinol palmitate / g of oil corresponding to a level of fortification between 5.25 µg RE / g and 6.9 µg RE / g which will cover between 25% at 33% of the daily needs of the adult (evaluated per day at 1428.6 IU)".

Of importance, nutrient addition levels as specified in the draft standards are not clearly stated and as a result have been differently interpreted by various stakeholders, specifically for vitamin A and iodine:

Vitamin A: The draft standard states "The recommended daily intake of vitamin A is 28 mg of retinol palmitate per kg of vegetable oil, which gives an included fortification rate between 17.5 IU and 23 IU of retinol palmitate / g of oil corresponding to a level of fortification between 5.25 µg RE / g and 6.9 µg RE / g which will cover between 25% at 33% of the daily needs of the adult (evaluated per day at 1428.6 IU[2])".

[2] 1428.6 IU is equivalent to 429 micrograms

- It appears that the RANFOSE report interprets the standard of fortified oil as 28 mg of retinol palmitate /kg of oil, which is close to 15.02[3] mg RE/kg (50 IU/g) (as retinol palmitate is 55% retinol). The University of California, Davis used 15.02 RE/kg of oil to model the expected intake of vitamin A through oil fortification and results using this assumed fortification level is presented later in Part II: Food vehicle consumption and expected impact from LSFF of this report.
- At 15.02 mg RE/kg (50 IU/kg) and assuming a daily oil intake of 30 g/day, intake of vitamin A through fortified oil is 450 mcg/day (i.e., 1,500 IU/day). Using the Recommended Dietary Allowance (RDA) of vitamin A (700 mcg/d according to the National Academies of Sciences, Engineering, and Medicine) for an adult woman, this represents 64% of the RDA.
- **Given the issues with the amounts stated in the draft standard, the fortification level that USAID AFFORD has applied to this report is 5.25-6.9 mg RE/kg of oil; 5.25 mg RE/oil is the minimum target used to interpret quantitative test results**. At approximately 30 grams per capita per day, oil fortification at this range could contribute for 25-33% of an adult woman's RDA.

Iodine: The translated standard states: "All food salt for cooking or table must be supplemented with iodine in the form of potassium iodate (KIO_3) in a proportion such that the marketed product contains 40 ± 10 ppm of iodine (33.7 to 67.5 mg of KIO_3) per kg of salt".

- However, the estimated amounts based on KIO_3 are incorrect, as KIO_3 is 59.3% iodine. Thus, 40 ± 10 ppm (or mg/kg) of iodine actually calls for the addition of 51 to 84 mg/kg of KIO_3.

Food fortification background

Past and current LSFF activities

Wheat flour millers, large oil importers, and the only local salt processor that fortifies (Bon Sel Dayiti) reported during interviews that they fortify their products in accordance with the specified requirements in the draft version of the standards. Some of them have received support from USAID RANFOSE, including equipment, training, and testing materials. However, regulatory monitoring is currently not taking place in Haiti, and concerns persist about the actual proportion of fortified foods produced by the private sector.

Definition of LSFF

We classify processors (per the USAID LSFF Programming Guide 2022) as large-scale if they process more than 30,000 metric ton (MT)/year of salt, 45,000 MT per year of wheat flour, 15,000 MT per year of edible oil (USAID, n.d.). Due to low production, two out of three local wheat flour millers meet this criterion. Salt processing is predominantly carried out by small-scale artisanal producers/processors, and the local output falls short of reaching the required threshold. All oil is imported; there is no local production of edible oil.

[3] Actually 15.4 mg RE/kg

Legislative scope of food fortification

The 2017 Law on Micronutrient Food Fortification includes imported food under the legislative scope of mandatory food fortification. However, due to the lack of border control and testing, the fortification status of imported products is uncertain. For these products, the fortification process should occur abroad, conducted by the food processors. In the cases of both oil and salt, the market is inundated with various imported brands, many of which bear labels in foreign languages and lack any labeling that indicates fortification.

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Part I: Industry feasibility of LSFF

I.I Objective

The objective of the industry feasibility assessment was to describe the industry landscape for the mandatory staple foods in Haiti (salt, edible oil, and wheat flour) and bouillon cubes, including food vehicle's penetration in the Haitian market, import amounts, main companies operating in the sector, market share by company (and brand when possible), technical feasibility for food processors to fortify and the fortification status of the three mandatory foods.

The rice, sugar, and Akamil (Aka 1000) industries were also included in this assessment to explore new options for fortification, even if they are currently excluded from the 2017 Law on Micronutrient Food Fortification.

I.II Methodology

Industry assessment methodology

USAID AFFORD leveraged a wide range of resources for the in-depth desk review. These included reports and data published by USAID, World Bank, Global Fortification Data Exchange, Food Fortification Initiative (FFI), Ministère de la Santé Publique et de la Population (MSPP), DHS, World Food Program (WFP), Ministère de l'Agriculture, des Ressources Naturelles et du Développement Rural (MARNDR), Conseil National de Sécurité Alimentaire (CNSA), University of Notre-Dame, Famine Early Warning Systems Network (FEWS- NET), as well as press articles and other sources.

20 key informant interviews were held with different categories of stakeholders:

- Private industry stakeholders ranging across the different value chains from importers, millers/processors, wholesalers, and retailers.
- Government entities
- International institutions

See Annex 1 for the list of interviewed stakeholders. Interviews were conducted both remotely and face-to-face.

Market assessment methodology

To describe the status of food fortification, 201 food samples were collected: wheat flour (n=20); salt (n=39); bouillon cubes(n=91); and edible oil (n=51) and analyzed for the presence of micronutrients. Three diverse locations across the country were selected:

- Port-au-Prince, the capital and Haiti's most populous city which faces significant challenges due to gang activity.

- Cap-Haitien, the largest city in the Northern region, known for its wide variety of products from the DOMR that are available for purchase.
- Les Cayes, situated in the Southern part of the country, where the available brands slightly differ from those in Port-au-Prince.

In each of these cities, five types of shops were visited (one supermarket, one open-air market, one retail shop, one wholesale market, one bakery). All the available brands were purchased and later sent to the Instituto de Nutrición de Centro América y Panamá in Guatemala for qualitative and quantitative analysis. All samples of oil, wheat flour and salt were tested qualitatively to determine those that were fortified. Samples of bouillon cubes were not tested qualitatively as it was deemed too complex compared to just conducting a quantitative test. The testing protocol called for the preparation of composited samples per brand that tested positive. This was only possible for salt and bouillon cubes. In the case of wheat flour and oil, there were insufficient samples that tested positive. A full description of the market assessment methodology can be found here.

To calculate the proportion of fortified foods in Haiti, the results of the qualitative and quantitative tests were combined with market share estimates. Since only processor (not brand) market share was available, all brands were weighted equally and market samples collectively were assumed to be representative of a brand/importer's typical performance (i.e., if 6/10 of samples from a single processor across multiple brands tested positive qualitatively, then 60% of the processor's product was considered fortified to any level). The same extrapolation was made for quantitative results. The proportion of samples testing qualitatively positive and quantitatively above the minimum target level were multiplied by the processor market share to estimate the total proportion of product in Haiti that should be considered fortified above the minimum.

As the samples are from the marketplace, and not from the point of production, the results from the analysis cannot be inferred as a marker for processor compliance. Since 'compliance' is not accurate, the term 'fortification quality' has been used elsewhere to refer to results coming from market assessments. However in this report, we avoid the term 'quality' as it may refer to many other parameters other than nutrient levels. Instead, findings referred to whether samples were fortified at all (any fortification), or fortified below target minimums, within/at targeted levels, or above the target maximum, per the draft Haitian standard's targeted nutrient levels (except for wheat flour, which only specifies a minimum requirement).

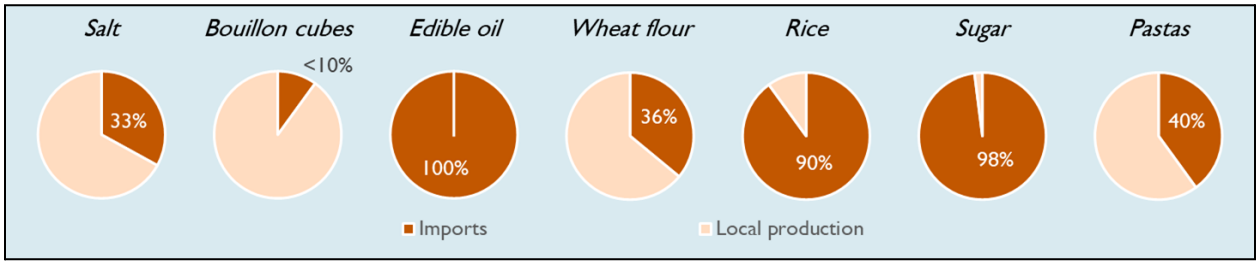
I.III Results

Haiti's reliance on imports

More than 50% of the food consumed in Haiti in 2015 was imported (Schwartz, 2015), and this proportion is likely to have increased further due to recent turmoil**.** Among the food vehicles

that fall under the mandatory legislation (salt, wheat flour and oil), salt and wheat flour are the only ones that are mostly produced locally **(Figure 3)**.

Figure 3: Proportion of imports per food vehicle



Wheat grain is imported from the US and Canada and milled locally, while two thirds of the salt is harvested in the country. A few DOMR wheat flour millers also export to Haiti to cover about one third of the demand. Refined edible oil is mostly imported from Indonesia (palm), Malaysia (palm) and the DOMR (soya).

Edible oil industry

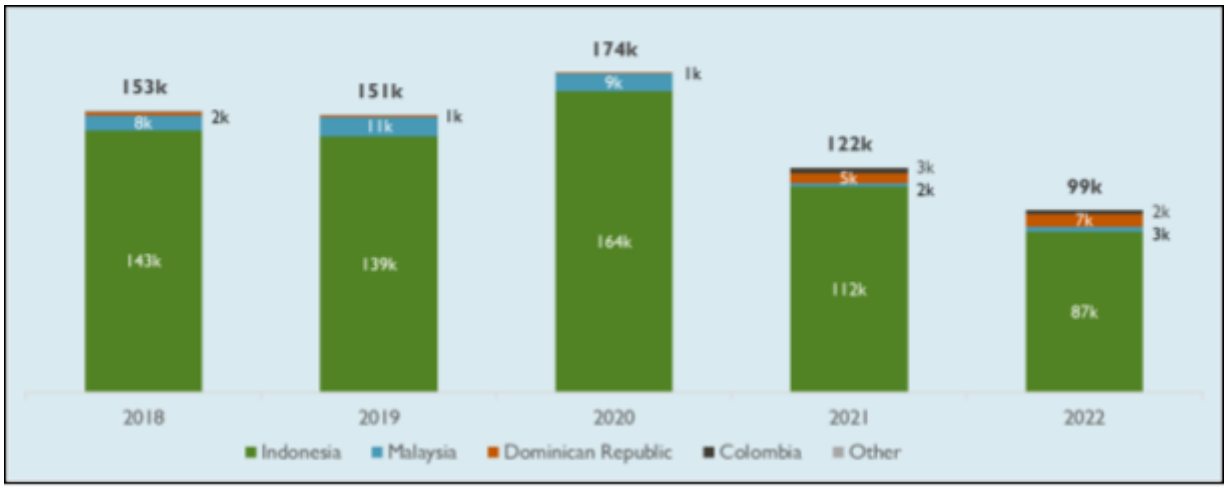
Overview

Stakeholder interviews estimated the Haitian edible oil market to be within the range of 120,000 to 150,000 MT per year. This amount represents 27-34 g/day of per capita intake. Haiti, not producing any edible oil domestically, heavily depends on foreign imports. According to interviews with large importers, oil consumption in Haiti has significantly decreased in recent years, a decline of approximately 30% in the past two years. This decline can be attributed to the country's challenging circumstances and the overall reduction in food consumption.

Although palm oil constitutes the bulk of the edible oil market, the proportion of soybean oil has observed a growth in recent years. In 2018, soybean oil accounted for less than 5% of the oil imports, whereas in 2022, its share had risen to over 20%. Many processors also sell blends of palm oil and soybean oil. Due to the current economic situation, the main driver behind the choice of edible oil is the price. As a result, higher-income Haitian restaurants tend to prefer soybean oil, whereas lower-income restaurants, especially those that specialize in deep-fried food, favor palm oil. Despite its higher cost, the increase in soybean oil imports may be attributable to import difficulties (e.g., regular port closures) and fluctuations in global oil prices.

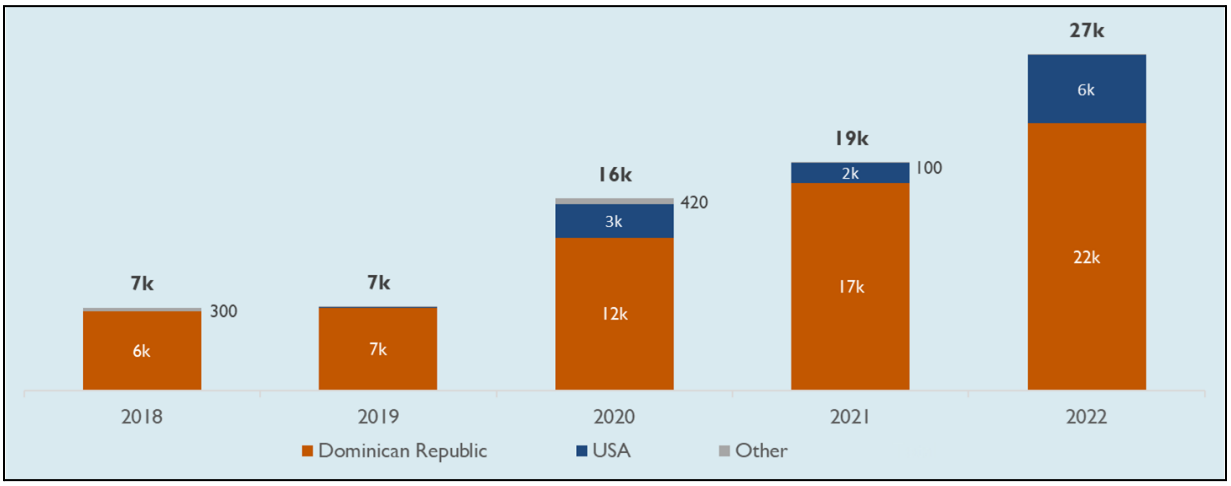
In 2022, Indonesia accounted for approximately 88% of Haitian palm oil imports, followed by the DOMR (7%), Malaysia (3%), and Colombia (2%). (International Trade Center - HS 1511) **(Figure 4)**. Approximately 81% of imports of soybean oil is imported from the DOMR (International Trade Center - HS 1507) **(Figure 5)**. The Dominican Republic imports both soybean meal and crude soybean oil from locations such as Argentina and the US, and refines and bottles the oil locally. Imports of oil from the DOMR are likely underestimated due to inadequate border control measures.

Figure 4: Palm oil imports in Haiti per country, MT



k, 1000; MT, Metric ton

Figure 5: Soybean oil imports in Haiti per country, MT

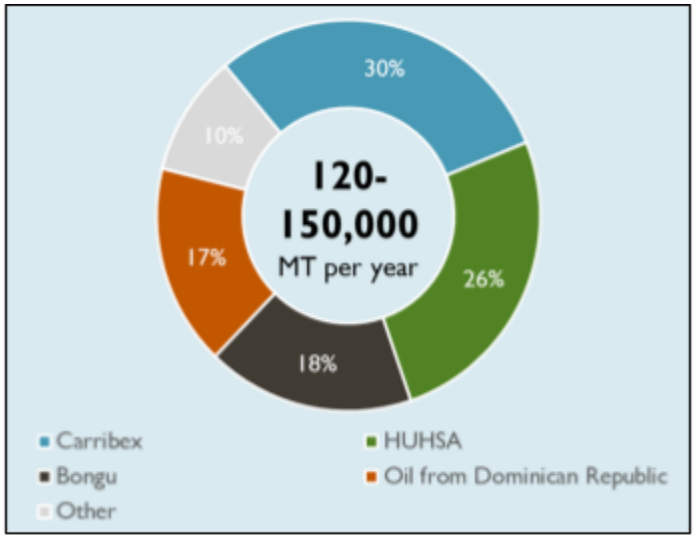


Main market players

The edible oil market is fragmented. Three large importers dominate a significant portion of the market, alongside numerous other active importers **(Figure 6).**

The trio of primary imports consists of Carribex with the brands Ti Malice & Citadelle, Huilerie Haitiennes, S.A. (HUHSA) with the brand Gourmet, and Cristo S.A., which distributes Bongu.

Figure 6: Market share estimates



HUHSA, Huilerie Haitiennes, S.A.; MT, metric ton

Carribex and HUHSA import bulk refined palm oil from Malaysia and Indonesia, subsequently bottling it within Haiti. Bongu imports oil that is already bottled.

Oil imports from the DOMR are primarily concentrated in the Cap-Haitien region due to its proximity to the border, but can also be found in most urban areas across Haiti. The most common brands are Crisol and Mazeite.

Diverse brands can be found in the markets, sourced from neighboring countries as well as Malaysia and Indonesia. Some importers are not the exclusive distributors of the brands they distribute, instead making opportunistic decisions based on daily oil prices. The assessment identified several prevalent brands, including Nina, Purela, and Alberto.

There are no visual differences in the packaging of palm oil and soybean oil. Both are commonly found in transparent bottles, and opaque jerry cans were also found on the market. Vitamin A fortified oil should optimally be stored in opaque containers to avoid vitamin A deterioration. Additionally, retailers also repackage bulk edible oil in repurposed plastic bottles, filled from larger oil jerrycans. Repackaged edible oil bottles do not indicate any information about the brand, the processor, or the origin.

Fortification feasibility

All oil is fortified at origin, prior to importation to Haiti. Large importers bring in pre-refined edible oil, primarily sourced from Malaysian and Indonesian processors who fortify the oil based on specific orders. Even for importers who bring in oil in bulk and repackage it locally, there is limited interest in local fortification due to the higher associated costs. USAID RANFOSE provided Carribex with an iCheck device in the first quarter of 2023 to check the fortification status of the oil that they import. In 2019, USAID RANFOSE reported that 80% of the oil available in Haiti was fortified (Climat, Régis, and Joseph, 2021).

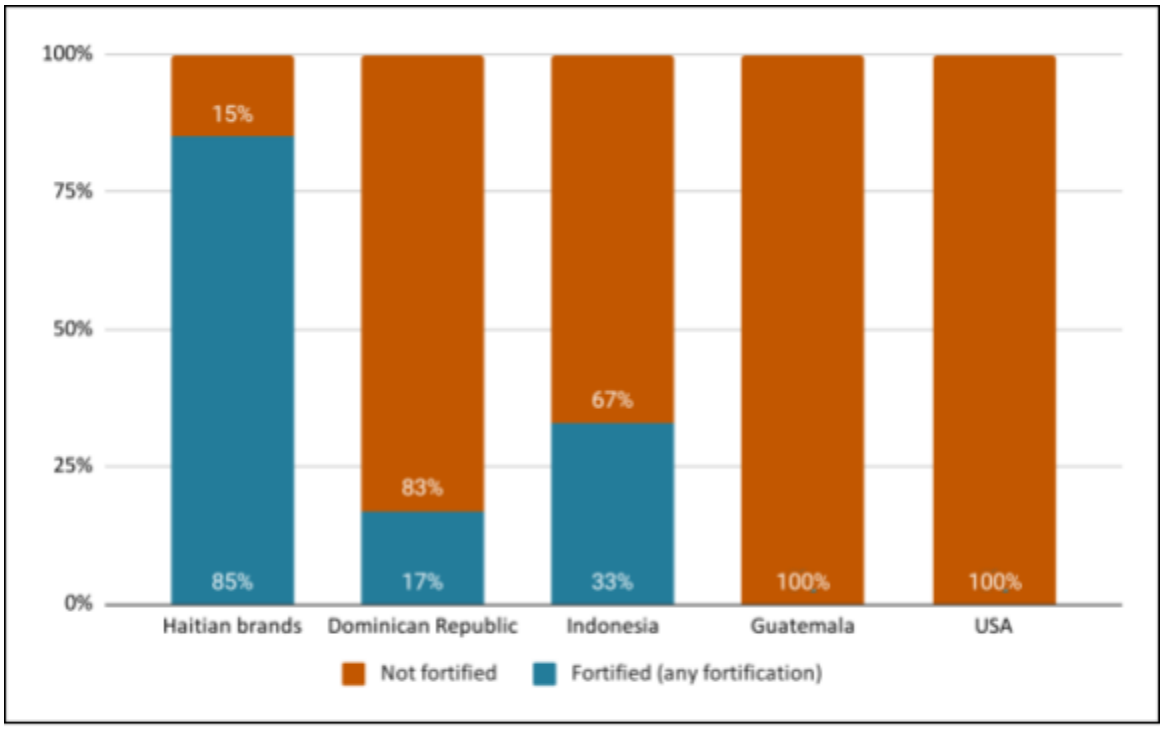
Foreign processors of palm oil are large industrial processors who should not have technical restraints with fortifying oil - one interviewee stated that their palm oil supplier is accustomed to fortifying oil. Most large importers report being in favor of fortification. Some of them also fortify non-mandatory products (e.g. Carribex fortifies margarine with vitamin A).

The three large importers indicate on their bottles that their oil is fortified, but it is not the case of other more opportunistic importers. Since Haiti is the only country in the region with mandatory oil fortification, it is likely that oil not produced specifically for sale in Haiti is not fortified.

Market assessment results

A total of 51 edible oil samples were collected from the three previously mentioned regions. Eighteen samples (35.3%) tested positive for any fortification. Eighty-three percent of Haitian brand samples were fortified, compared to 17% of samples from the DOMR, 33% from Indonesia, and none from Guatemala and the USA **(Figure 7).**

Figure 7: Proportion of oil samples fortified (any fortification), by source/country of origin[1]



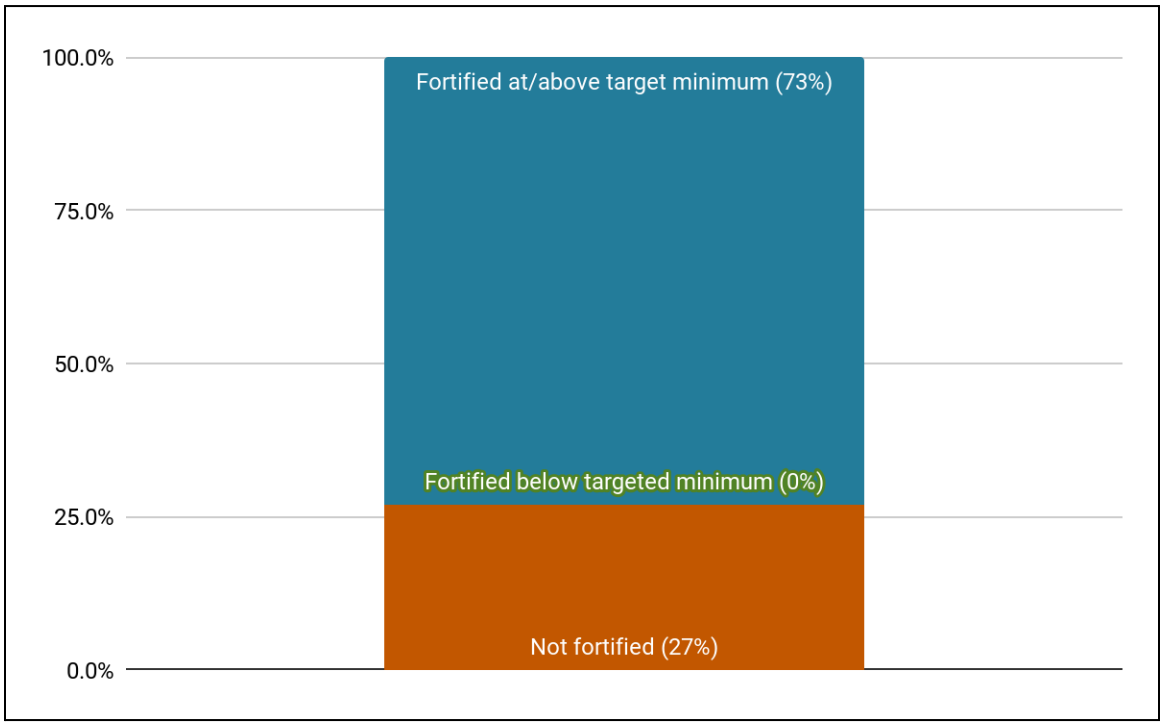
[1] Although no oil is actually produced in Haiti, oil that was bottled/imported by the main Haitian producers described above were labeled with 'Haiti' as the country of origin.

Of the samples from Les Cayes 73% tested positive for any fortification, compared to 39% in Cap-Haitien and 14% in Port-au-Prince**.**

Quantitative testing was done on all positive single samples (instead of compositing) because of the small number of positive samples. The average vitamin A level was 19.6 mg retinol equivalents (RE)/kg and the results ranged from a minimum of 8.1 mg RE/kg to a maximum of 31.2 mg RE/kg. All of the positive samples were above the target minimum specified in the standard (5.25 mg RE/kg). Oil imported and packaged by Haitian companies had higher vitamin A levels than international imported oil brands (22 mg/kg vs. 16 mg/kg). Since processors appear to be fortifying on average 3-4 times the minimum target level, it is possible that processors have a different interpretation of the vitamin A fortification addition levels. Indeed, one company behind Haitian-branded oil stated the fortification requirement was 50 IU/kg (i.e., 15 mg/kg).

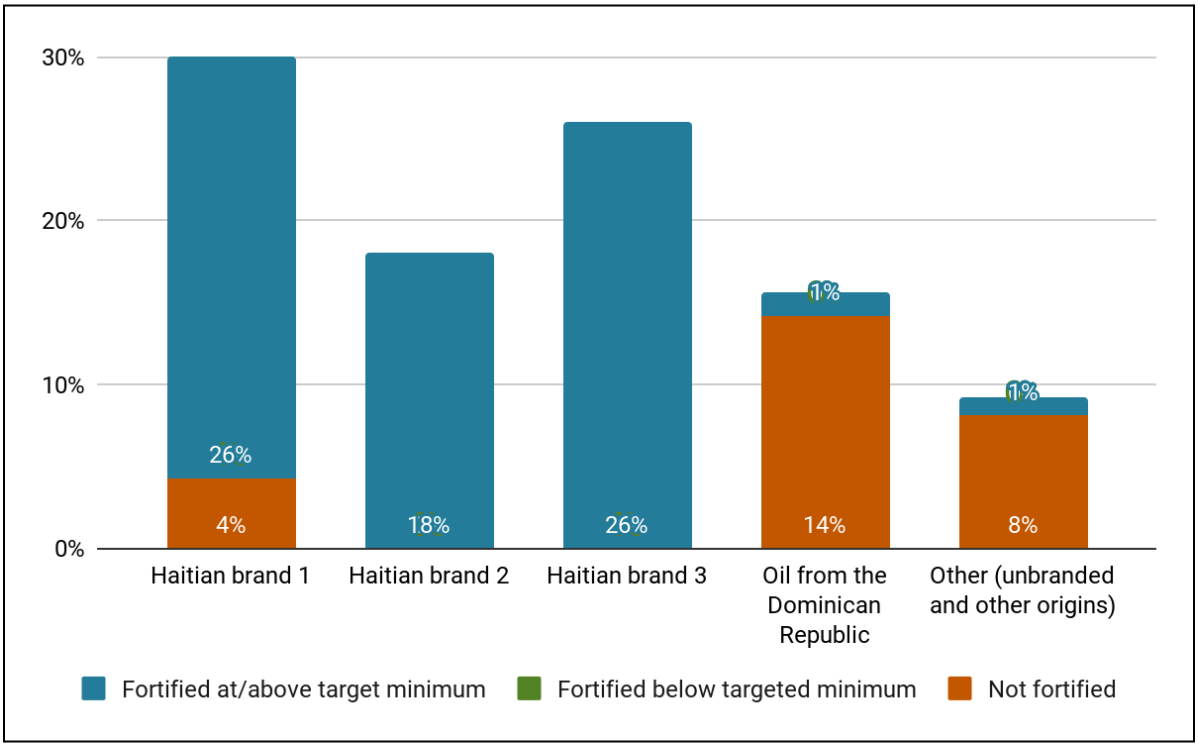
After incorporating market share previously described in **Figure 6**, we estimate that 73% of the edible oil in Haiti is fortified at/above the targeted minimum level for vitamin A, none is fortified below the target minimum, and 27% is not fortified (**Figure 8**).

Figure 8: Fortification status of the edible oil market in Haiti



When disaggregated by source (processor and origin), it becomes clear that the non-fortified oil is primarily coming from the DOMR and other international sources. Oil by the primary three Haitian importers is nearly all fortified and fortified at/above the draft standard's targeted minimum level (**Figure 9**)[4].

Figure 9: Fortification status of the edible oil market in Haiti, by source

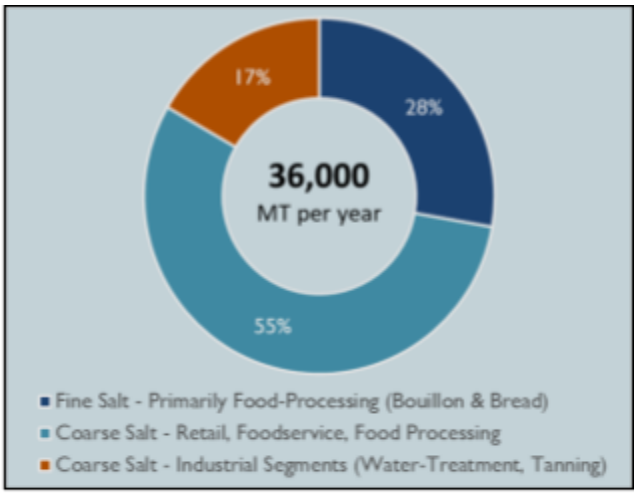


Salt industry

Overview

The Haitian salt market is estimated to be around 36,000 MT per year (Reimer et al., n.d.) (~6.6 g/day per capita) **(Figure 10)**. Approximately eighty percent of this salt is used for human consumption (even where it may not meet minimum standards for food-grade salt) Coarse salt constitutes the majority of the salt in the market. However, certain food processors such as bakeries and bouillon cube manufacturers require higher quality fine salt, which complies with food grade salt requirements. The remaining (17%) is coarse salt used for industrial purposes, such as tanning and water treatment (Reimer et al., n.d.).

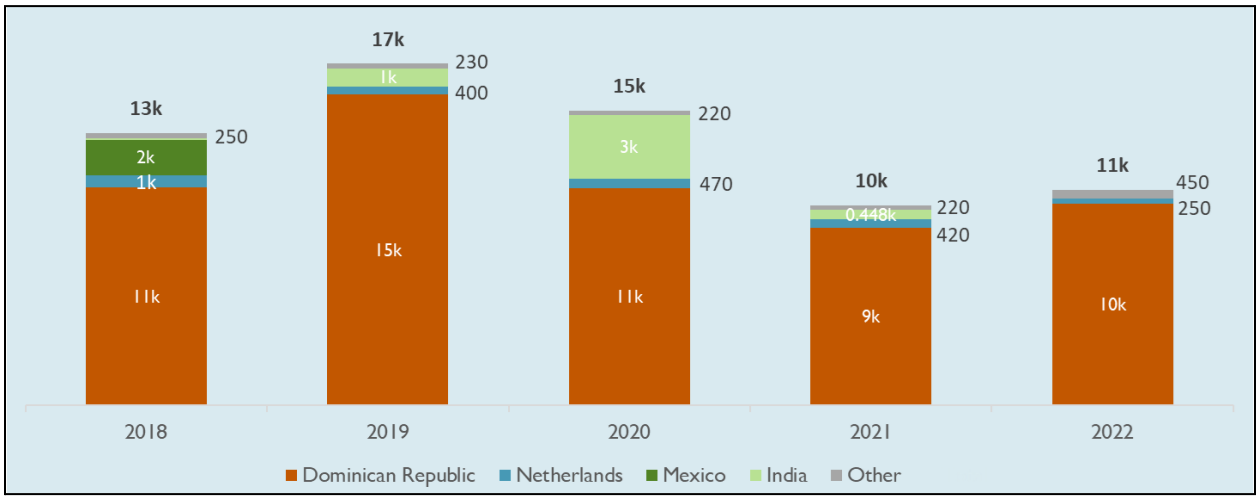
Figure 10: Salt demand per sector



MT, metric tons

Haiti produces between 25,000 MT and 30,000 MT of salt per year, depending on rainfall patterns. The local production is primarily centered in Anse Rouge and Gonaives, within the Artibonite region, and involves thousands of small-scale artisanal processors. The remaining portion of consumption comprises imports, including both coarse and processed salt from the DOMR and fine salt from various countries, including Mexico, and India (International Trade Center HS 2501) **(Figure 11)**.

Figure 11: Salt imports in Haiti by country, MT



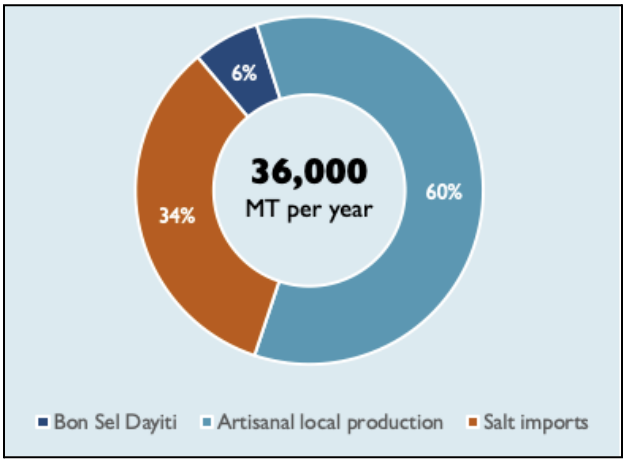
k, 1000; MT, metric ton

Main market players

Local artisanal producers contribute to the majority (60%) of the salt available in the market **(Figure 12).** This artisanal salt is usually unbranded coarse salt sold in bulk, but can also be

packaged and branded by supermarkets that sell the salt. Customers then wash and crush this salt at home. Only 6% of the demand is supplied by Bon Sel Dayiti, and 33% is imported salt.

Figure 12: Salt market share estimates by producer/processor/origin, MT



Bon Sel Dayiti is the only processing facility in Haiti capable of washing and fortifying salt. They receive technical support from Cargill and obtain salt from local artisanal producers for processing and iodization. Due to the subpar quality of salt produced in Haiti, Bon Sel sometimes needs to import and process Dominican salt when higher purity is required by clients, particularly in the food processing industry.

Numerous international salt brands are available in Haiti, with the brand Refisal from the Colombian company being particularly prominent. Unbranded Dominican salt can also be found in open-air markets.

Fortification feasibility

The feasibility of salt iodization in Haiti is very low, as it is mostly produced by the informal sector. None of the local producers process a quantity substantial enough to meet the criteria for large-scale fortification, which is set at 30,000 MT (USAID, n.d.).

The coarse salt produced by local and Dominican artisanal producers faces fortification challenges due to several factors. Producers report lack of the required equipment, training, and resources for fortification. When fortified, Haitian coarse salt faces challenges related to fortification due to its low quality, characterized by notably low purity and high moisture content. The elevated moisture content can lead to rapid loss of iodine if the salt is not promptly consumed.

Bon Sel Dayiti, an non-governmental organization originally started as a project under the University of Notre-Dame over 30 years ago, produces two types of fortified salt: the iodized salt and double fortified salt with iodine and diethylcarbamazine to treat lymphatic filariasis. Iodized Bon Sel salt is available in retail settings and is also supplied to food processors.

Fine salt that is processed outside of Haiti is likely to be undertaken by large-scale food processors. Since the iodization of salt is mandatory in Latin American countries, imported salt that has undergone processing is expected to be iodized, or at minimum, the producers have the capacity to fortify if requested.

Previous data available suggests that salt iodization is low overall. USAID RANFOSE estimated in 2019 that only 16% of the salt sold in Haitian markets was fortified (Climat, Régis, and Joseph,

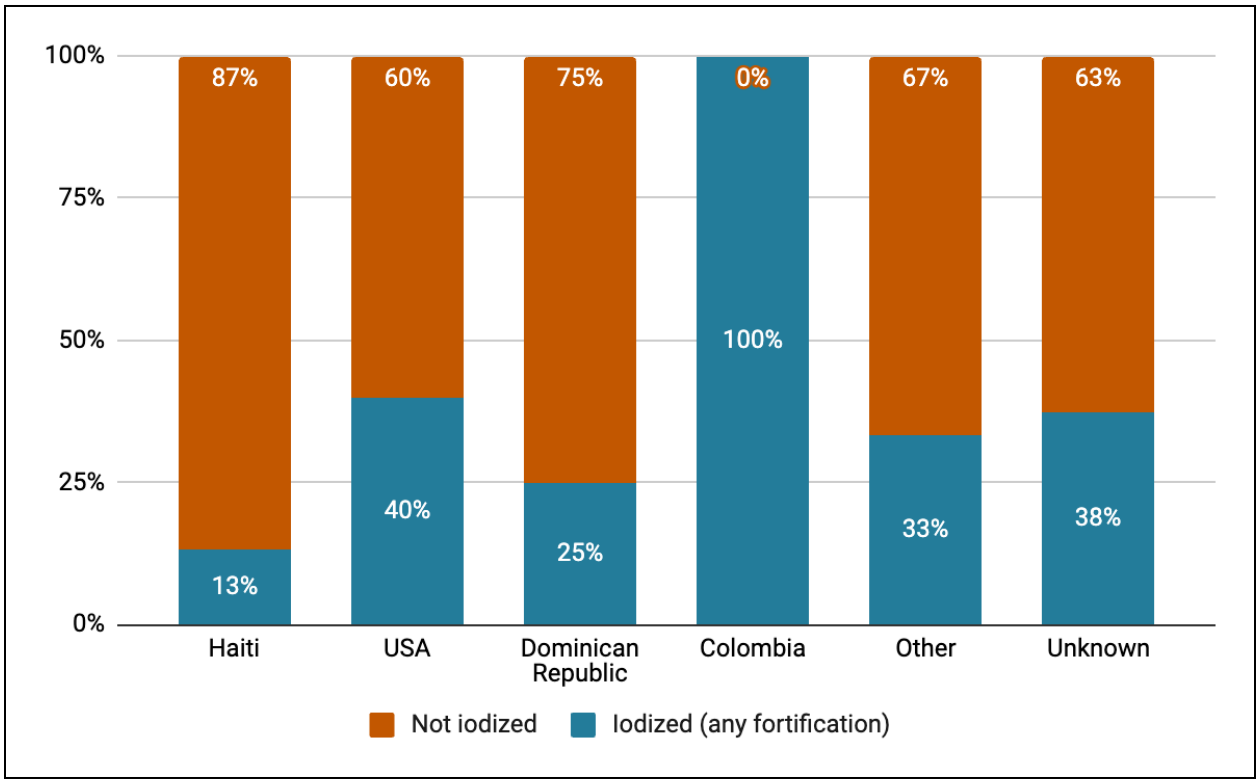
2021), while the World Bank reports that only 8% of Haitian households consumed iodized salt in 2017[5] (World Bank Open Data, n.d.). Eight out of 15 brands collected label their products as fortified, representing 10-15% of the market.

Regarding packaging, Bon Sel Dayiti is the sole local brand that states on its packaging that the salt is fortified. There is no available information about unbranded salt sold in markets. While the packaging of most imported fine salt indicates iodization, labeling is not always consistent.

Market assessment

A total of 38 salt samples were collected from three regions in Haiti; 31.6% (12/38) tested positive for any fortification[6]. Of the positive samples, five samples (41.6.%) tested positive for iodate and seven (58.3%) tested positive for iodide. Only two samples of salt produced in Haiti were iodized (one coarse, one refined). The remaining iodized salt was imported, coming from Colombia (3), USA (2), France (1), and DOMR (1). Three fortified samples were not marked with country of origin (**Figure 13**). Of those fortified, the majority (46.7%) came from Cap Haitien, followed by Les Cayes (30%) and Port au Prince (15.4%).

Figure 13: Proportion of salt samples fortified (any fortification), by source/country of origin

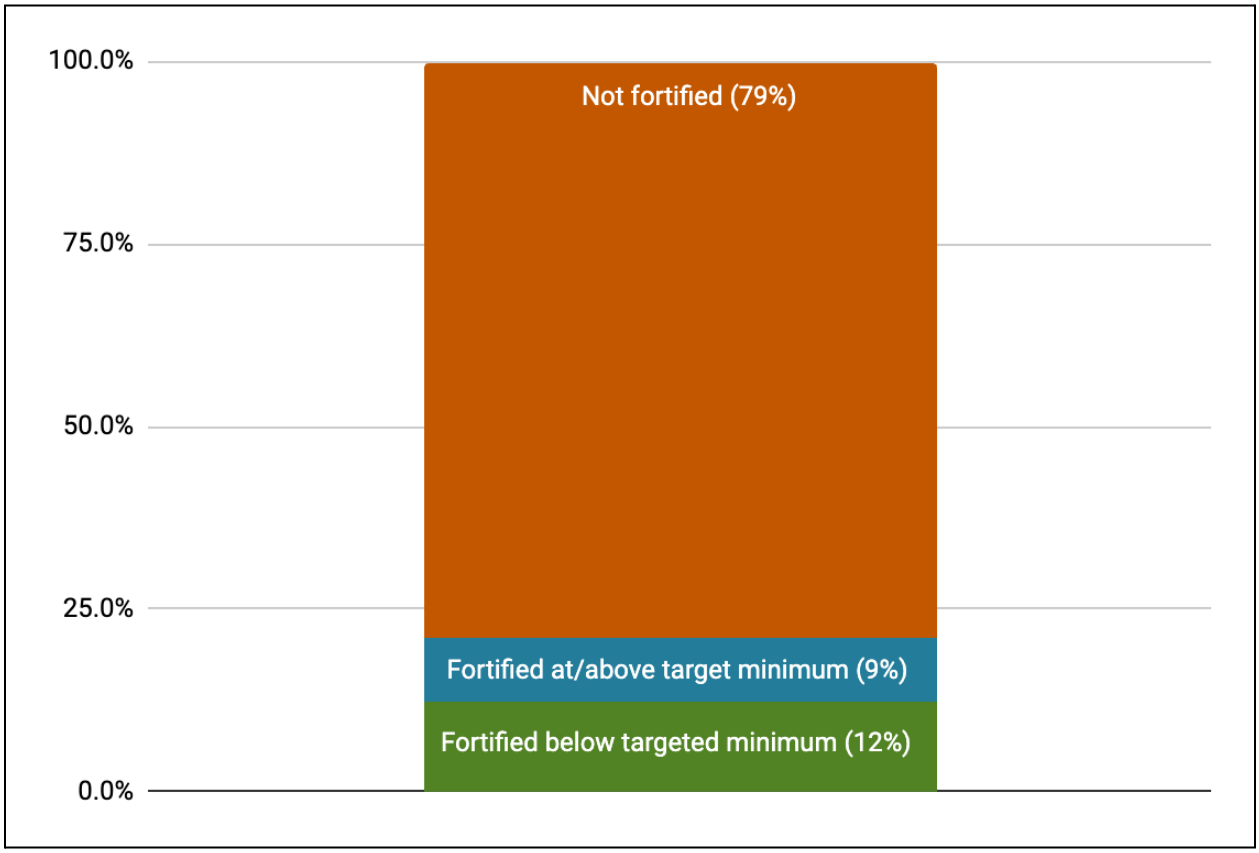


[5] While the World Bank labels this data as 'consumption', the original source of data is the UNICEF Global Database on Iodized salt, and thus likely only captures the presence of iodized salt in the household on the day of the survey.

[6] All 38 samples were found qualitatively positive for iodide or iodate. However, quantitative testing identified 25 false positives after composite samples were tested. The results here rely on the quantitative testing to classify a sample as 'positive for fortification'.

After removing false positive composite samples (n=17)[7], there were ten valid composite samples. Six samples had iodine content lower than the target minimum (30 mg/kg) and four had iodine content higher than the target minimum. Haiti's draft standards for iodized salt is higher than the World Health Organization (WHO) recommended minimum (20 mg/kg) when the salt intake is 10 g/day; using this minimum as a cut-off, seven of the valid composite samples (70%) had iodine content above the WHO recommended minimum (WHO, 2014).

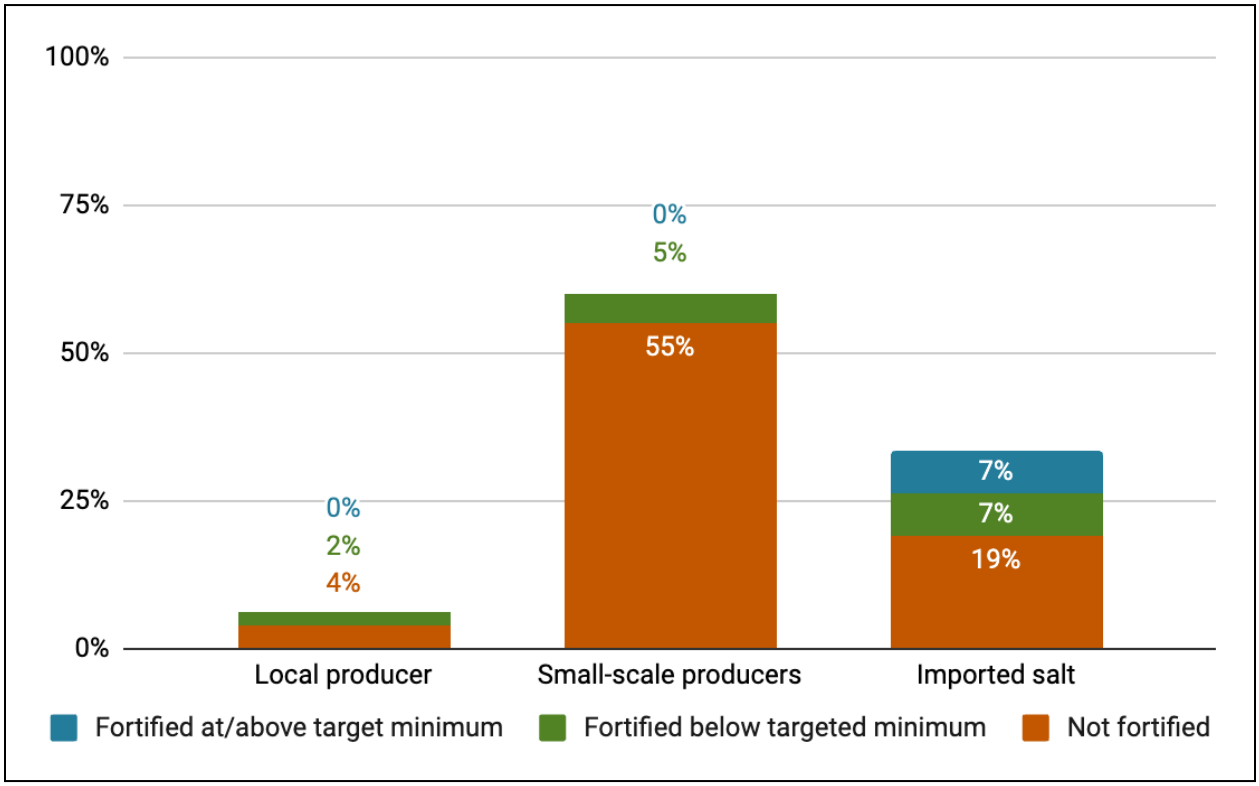
Figure 14: Fortification status of the salt market in Haiti



After incorporating market share previously described in **Figure 12**, we estimate that 9% of the salt in Haiti is fortified at/above the targeted minimum level for iodine, 12% is fortified below the target minimum, and 79% is not fortified (**Figure 14**). When disaggregated by source (processor and origin), it becomes clear that imported salt is the predominant source of salt fortified to the targeted minimum **(Figure 15).**

[7]From 38 single samples, 27 composite samples were created. Of those, only 10 (comprised of 12 individual samples) were found quantitatively positive. Thus, all of the single samples comprising the 17 composite samples with iodine levels <2 mg/kg were re-classified as not positive.

Figure 15: Fortification status of the salt market in Haiti, by source[1]



[1] The category of imported salt includes three salt samples that were labeled without country of origin. Because of the need to attribute market share to samples, this analysis could not include a category of 'unknown'. Two of the salt samples were listed as sold by importers; the third is unknown.

Bouillon cube industry

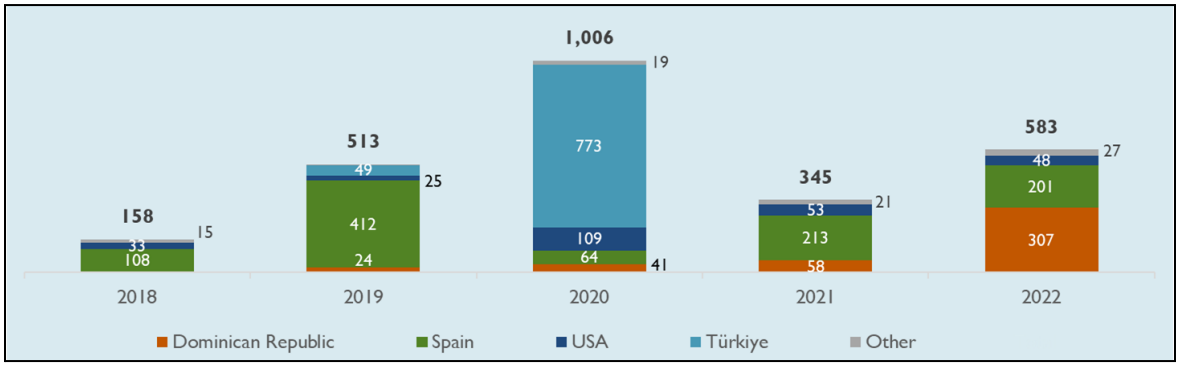
Overview

Haiti stands as a substantial consumer of bouillon cubes, with the market estimated to be around 8,400 MT annually (~1.9-3 g/day per capita[8]). This quantity represents approximately 2.0-2.2 billion individual bouillon cubes per year (Reimer et al., n.d.) or 0.5 bouillon cube/day per capita. If 90% of bouillon is locally produced and 60% of bouillon cubes is composed of salt[9], then ~4,500 MT of salt is used by local bouillon processors. This represents 32% of the fortifiable salt in the country (either domestic or imported). If an individual's sole source of iodized salt in the diet comes from bouillon, that comes to only 1.14 g/day per capita of iodized salt consumption. For bouillon cubes alone to contribute significantly to iodine intake, high iodine content is needed off the salt used in the production of bouillon cubes.

The majority of bouillon cubes are manufactured within the country by two distinct processors (>80%), while a minor portion is brought in through imports from foreign sources (2.8%) (International Trade Center HS 2104) **(Figure 16).**

[8] Amount ranges as bouillon cubes can range in size across producers.
[9] The salt content of bouillon cubes ranges by brand and producer. In West Africa, salt content of bouillon cubes has been documented to range between 40-70%.

Figure 16: Bouillon cube imports in Haiti by country, MT



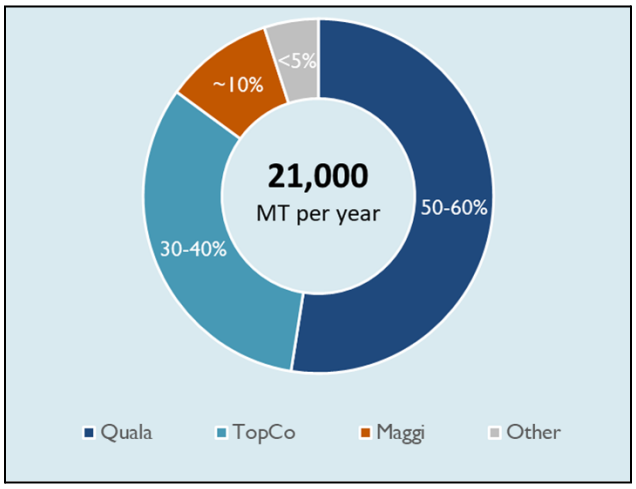
MT, Metric ton

The quantity of imported bouillon cubes experiences notable fluctuations, contingent upon both the years and the specific country of origin.

Main market players

The bouillon cube market is very concentrated in Haiti **(Figure 17)**.

Figure 17: Market share estimates across bouillon cube manufacturers



Three bouillon cube manufacturers account for more than 90% of the market:

- The Colombian company Quala operates a local Haitian processor SunFoods S.A. (Kupet Dwèt, Sunia) and holds a dominant position in the Haitian market. Quala acquired SunFoods S.A. in 2018 and continues to sell products under its brands: El Criollito in Haiti and Don Poyo in the DOMR. Most of the bouillon cubes that are sold in Haiti are manufactured domestically, but cubes produced for the DOMR are regularly found in Haitian markets.
- Topco started to process cubes in Haiti a few years ago and has become the largest competitor to Quala under the brands Zin and Kay Lucien.
- Maggi (an imported brand) is also very popular in Haiti, with its brand name (Djon Djon) even associated with a Haitian rice recipe known as Rice Djon Djon. Maggi bouillon cubes tend to be more expensive than those of its competitors.

Other brands such as Jumbo can be found in Haitian markets, but rely mostly on opportunistic importers.

Fortification feasibility

Using iodized salt in the production of bouillon cubes is feasible. Both major processors report using fortified salt. Quala is a customer of Bon Sel D'Ayiti, while Topco imports finely iodized salt

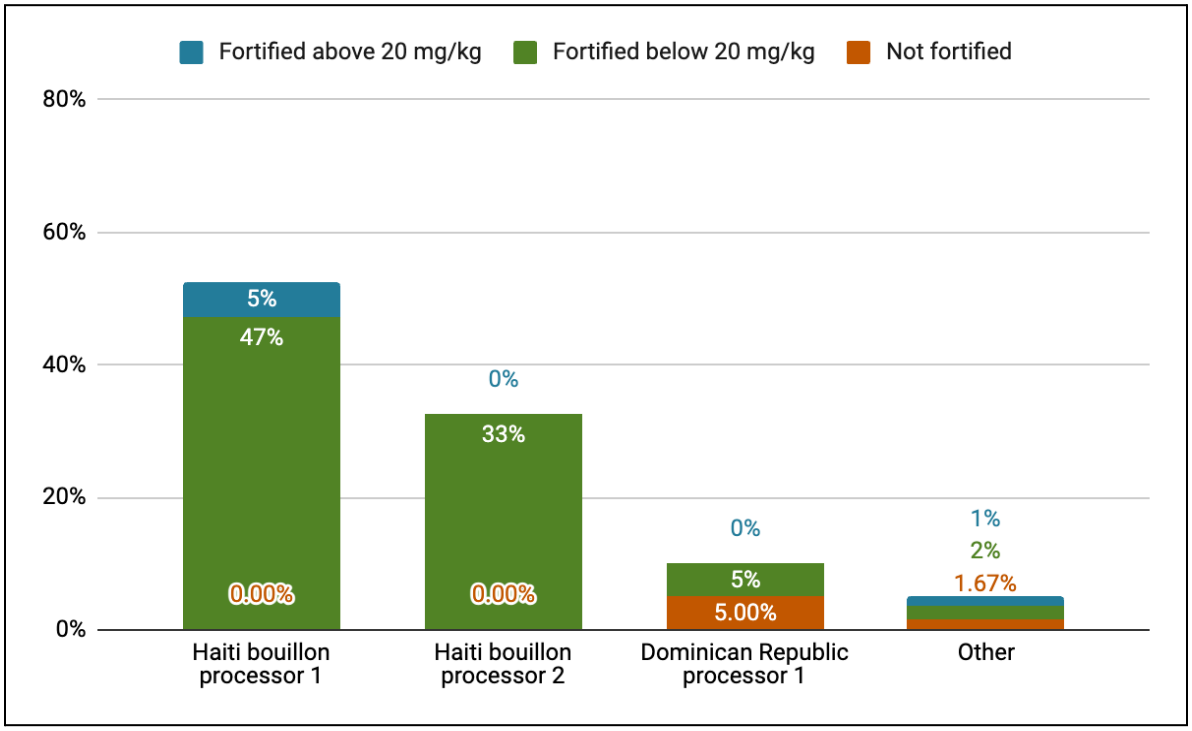
from abroad. For most brands, the packaging does not mention any information about iodization.

Market assessment

A total of 91 bouillon cube samples were collected from three regions in Haiti. Since a qualitative test for iodine in bouillon cubes is not available, only quantitative analysis was done on these samples. Eighty-two percent of bouillon cubes (27 of 33) were iodized and 18% (6 of 33) of bouillon cube composite samples did not contain iodine, indicating that iodized salt was not used during manufacturing. Among positive composite samples, the mean ± standard deviation (SD) iodine content was (15.5 ± 7.2) mg/kg.

Since fortification of bouillon cubes directly is not mandatory, fortification status according to standards for the overall bouillon cube market is not presented. However, after incorporating market share previously described in **Figure 17** and disaggregating by source (processor and origin), it is apparent that locally produced bouillon cubes are using iodized salt and the iodine levels are in line with expectations if bouillon cubes were 50% salt. Non-fortified bouillon cubes are primarily coming from the DOMR and other international sources (**Figure 18**).

Figure 18: Fortification status of bouillon cubes in Haiti, by source[1]



[1] There are no standards for bouillon cube fortification. However, all processed food in Haiti should be using iodized salt during production. The 20 mg of iodine per kilogram of bouillon cube is approximately the amount of iodine that would be present if bouillon cubes composition is 50% salt iodised to the target level of 40 mg/kg according to the standard.

Wheat flour industry

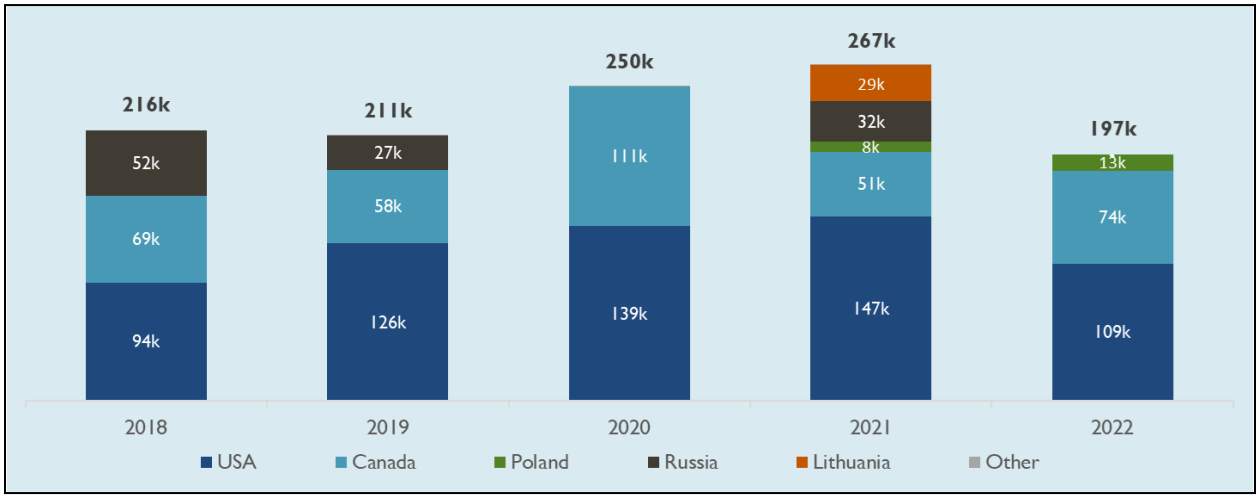
Overview

The wheat flour market is estimated to range from 180,000 to 200,000 MT per year (i.e., 45 g/day per capita). Bakeries represent the majority of wheat flour utilization in the country. Since Haiti does not produce wheat grain, the country relies on imports, in particular from the US and Canada (International Trade Center HS 1001) **(Figure 19)**.

Local production of wheat flour is supplemented by imports of wheat flour from the DOMR and previously from Türkiye (International Trade Center - HS 1101) **(Figure 20)**.

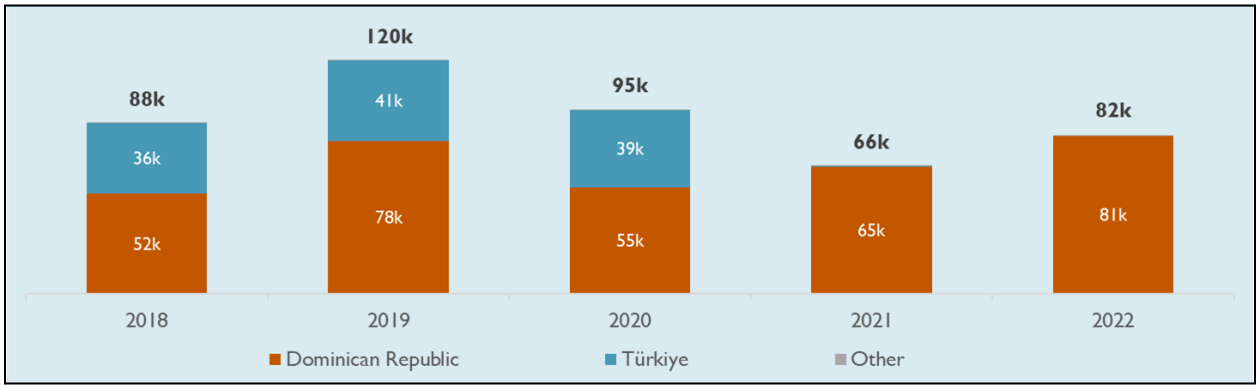
The wheat flour imports from Türkiye ceased in 2021 due to the decision of the importer to open their own wheat flour mill. Imports from the DOMR may be underestimated because of limited border controls, and some importers are known for evading customs taxes. The Haitian government has banned imports from the DOMR several times due to concerns about the use of a banned flour improver, bromate. The use of bromate is banned worldwide but may still be in use in countries where the regulatory environment is weak.

Figure 19: Wheat grain imports in Haiti by country, MT



k, 1000; MT, metric ton

Figure 20: Wheat flour imports in Haiti by country, MT

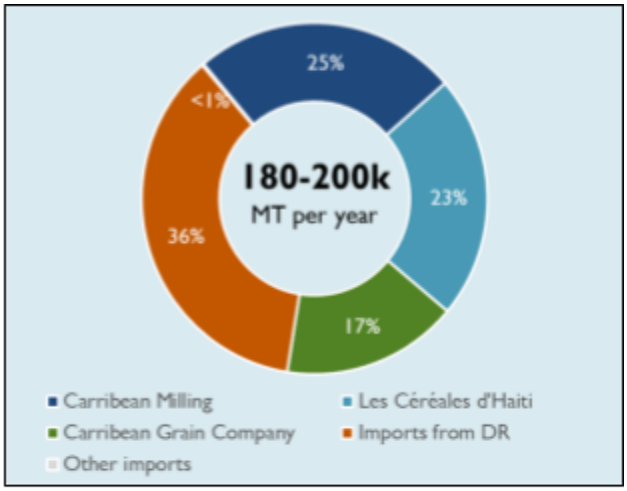


k, 1000; MT, metric ton

Main market players

The wheat flour market in Haiti is concentrated, with three local wheat flour millers currently in operation which account for most of the production in volume. The market shares are estimated as follows **(Figure 21)**:

Figure 21: Wheat flour market share estimates by flour miller/source



DR, Dominican Republic

Les Moulins d'Haiti, owned by Seaboard, previously held the largest market share in Haiti but closed after an attack by a gang in October 2022. The three local wheat flour millers currently operating are:

- Les Céréales d'Haiti (23%): This is the oldest operating mill, offering various types and brands of wheat flour. The brand "Reine du Sud" is especially prominent in the South of Haiti.
- Caribbean Milling (17%): They operate both a wheat flour mill and a semolina mill, distributing their entire production through Bongu. Their primary focus is on the region around Port-au-Prince.
- Caribbean Grain Company (Industries Acra) (25%): This recently established mill has limited available information, but reports indicate their activity in the same regions.

Due to significant gang activity in the center of the country, wheat flour millers face challenges in serving the Northern part of the country. Consequently, Dominican flour is commonly found in the Cap-Haitien region. Dominican millers (36%) use brands such as Princesa, Ozama, and Grupo Rafael Nunez.

One-kilo bags of imported flour can also be found in supermarkets under various brands such as Belle France and Netto.

Fortification feasibility

Two of the three local wheat flour millers regularly produce more than 45,000 MT of wheat flour per year each, making them eligible for large-scale fortification (USAID, n.d.). At least two wheat flour millers (Les Céréales d'Haiti, Caribbean Milling) reported having received support from USAID RANFOSE, which included equipment, testing, and training.

Wheat flour millers in the DOMR are likely to have the capacity to fortify their flour, as 100% of the flour is industrially milled (as DOMR does not produce wheat grain; all wheat grain is imported) and fortification is mandatory (Decree No. 528-01, 2001).
USAID RANFOSE reports that 75% of the wheat flour was fortified in 2019 (Climat, Régis, and Joseph, 2021). 4 out of 9 brands collected label their products as fortified, representing 65% of the market.

The packaging for locally produced wheat flour indicates that the wheat flour has been enriched with several micronutrients but does not make claims regarding the amount of micronutrients added. Given that wheat flour is commonly sold in bulk within the market, often in transparent plastic bags, the end-consumers typically do not see the "farine enrichie" labeling. Bags of Dominican flour, which are mostly available in the northern regions of the country, lack any information about their fortification status.

Market assessment

A total of 20 wheat flour samples were collected from three regions in Haiti. Ten samples (50%) tested positive for iron. All flour samples imported from the DOMR were fortified compared to 0% from France, while 33% of the domestically produced wheat flour samples were fortified **(Figure 22)**. All samples tested positive in Cap-Haitien compared to 40% in Port-au-Prince and 30% in Les Cayes.

Figure 22: Proportion of wheat flour samples fortified (any fortification), by source/country of origin

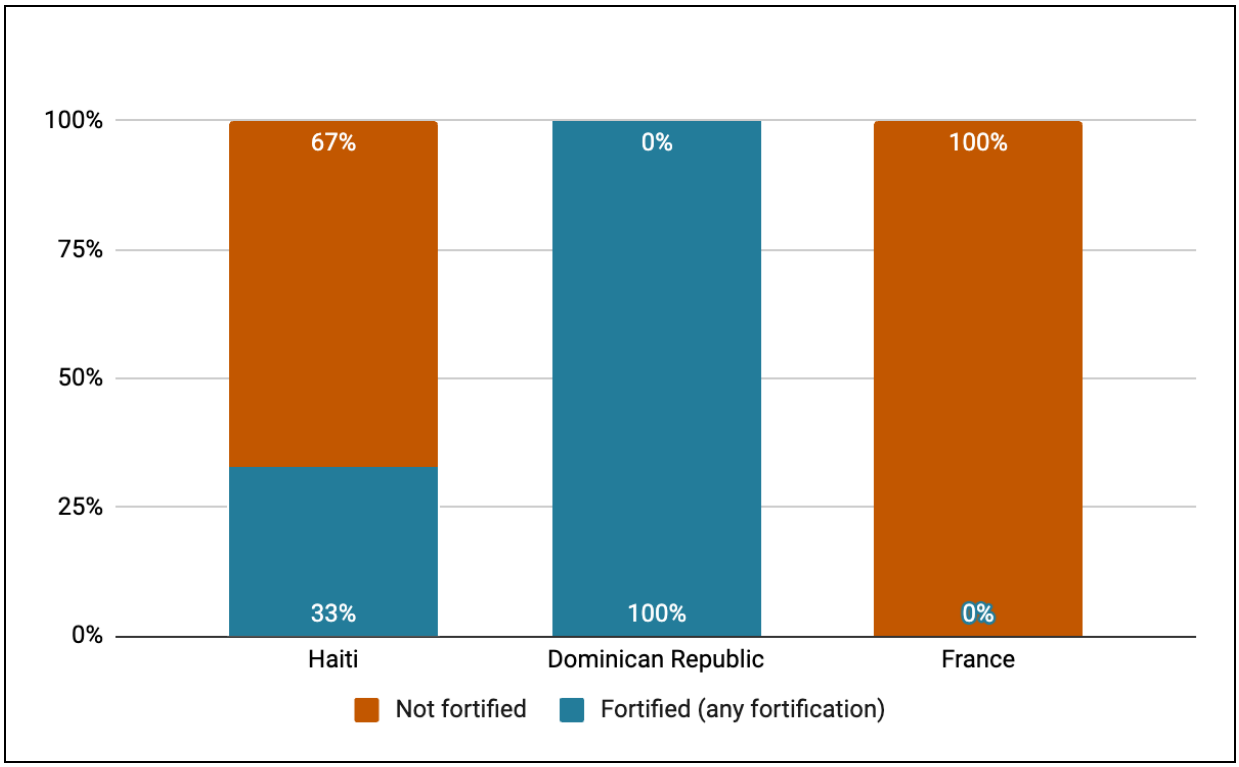
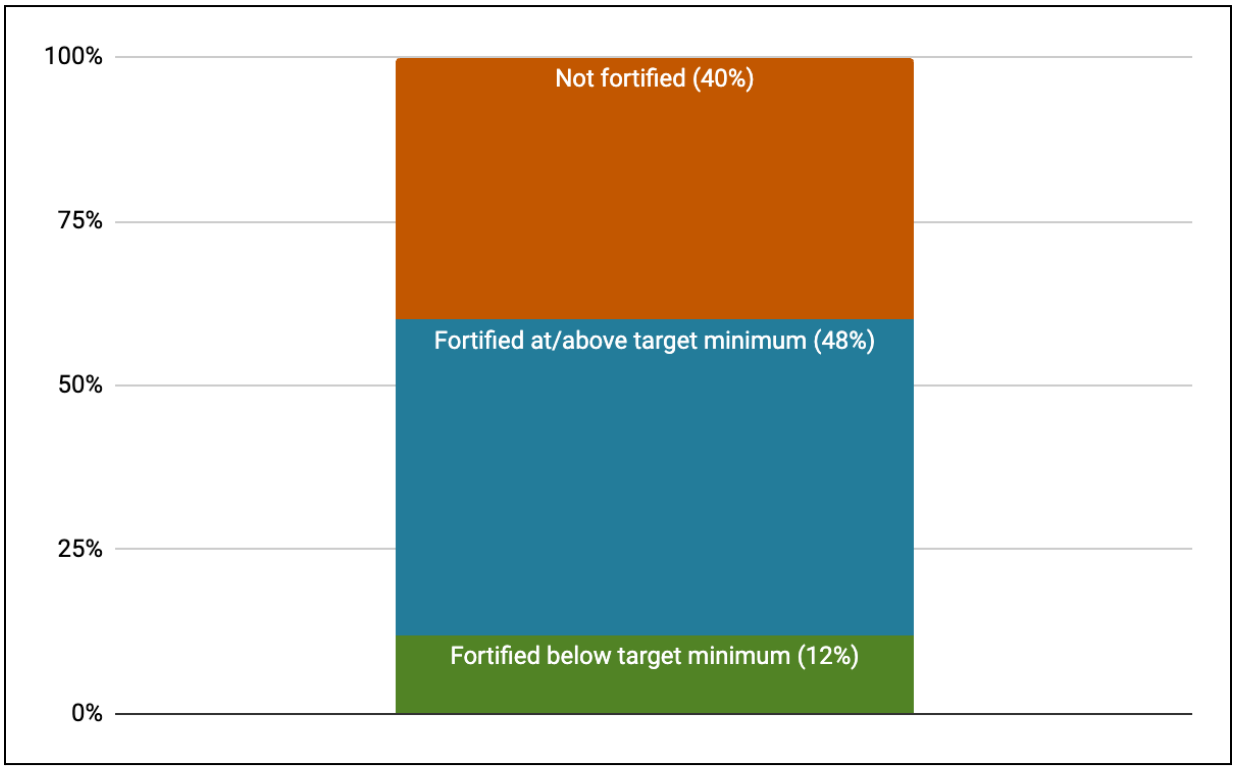


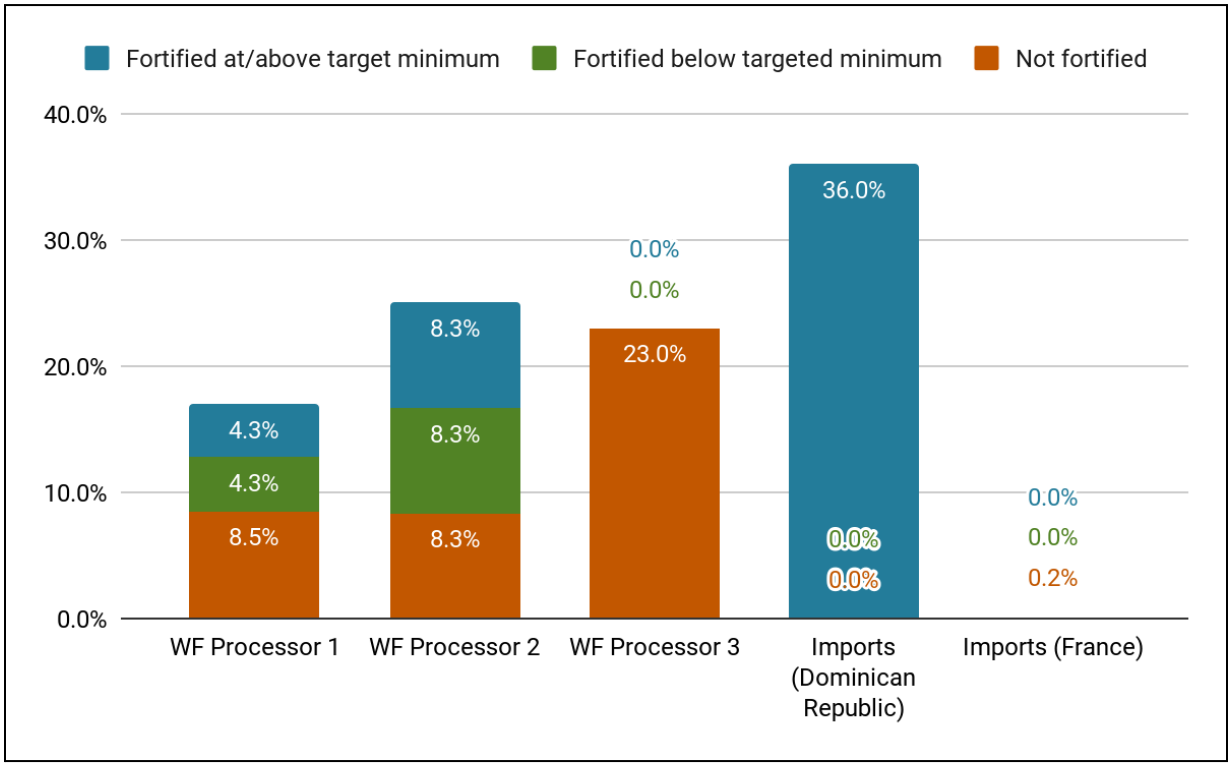
Figure 23. Fortification status of the wheat flour market in Haiti



Quantitative testing was done on those samples that tested positive (10). Results from the quantitative test suggest that 1 of the 10 samples was a false positive. From the nine samples, eight (89%) were above or equal to the draft minimum level for iron (30 mg/kg) and six (67%) were above or equal to the draft minimum level for folic acid (1.5mg/kg).

After incorporating market share previously described in **Figure 21**, we estimate that 48% of the wheat flour in Haiti is fortified at/above the targeted minimum level for iron, 12% is fortified below the target minimum, and 40% is not fortified **(Figure 23)**. When disaggregated by source (processor and origin), it becomes clear that the non-fortified wheat flour is attributable to the locally produced Haitian wheat flour - with one processor not fortifying entirely **(Figure 24)**. Flour coming from the DOMR is uniformly fortified with iron and folic acid, at levels in line with the DOMR's standard for iron in wheat flour (55 mg/kg) (not shown). Of note, although the DOMR's wheat flour standard for iron specifies iron levels nearly twice as high as Haiti, the DOMR is referring to ferrous fumarate, compounds with lower bioavailability than the compound specified for use in Haiti (NaFeEDTA). As a result, bioavailability of both compounds at their respective levels should be approximately similar.

Figure 24. Fortification status of the wheat flour market in Haiti, by source

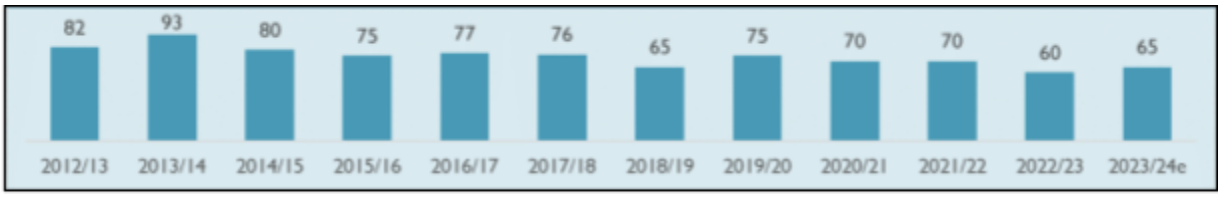


[Rice Industry]

Overview

Approximately 450,000 MT (i.e., 103 g/day per capita) of rice is consumed in Haiti annually. Rice production within the country has experienced a slightly decline in recent years and now accounts for 10% of the total consumption (USDA, n.d.) **(Figure 25)**

Figure 25: Annual rice production in Haiti, thousands of MT



MT, metric ton

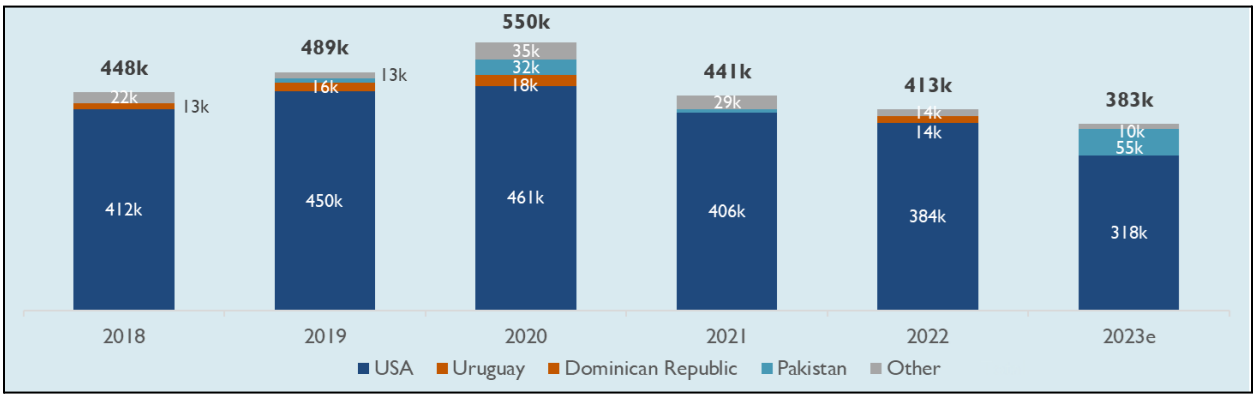
Several factors contribute to the challenges of local production, including low yields due to the poor quality of irrigation canals, lack of skilled labor, limited mechanization & storage facilities, and an outdated milling industry. Haitian rice production is also affected by climate events, particularly hurricanes, which can significantly impact total output.

Artibonite is the primary hub for rice production, and accounts for 94% of the total output in 2019 (MARNDR, 2019). Farmers in different regions cultivate various rice varieties depending on

factors like seed availability and local preferences. In Artibonite, the most popular varieties include Taichung Sen (TCS-10), Shella, Shelda, and La Crete. In other regions, different varieties such as Prosequisa 4 and M8 are cultivated.

Haiti initiated market imports in 1986, reducing tariffs on rice imports to 3% by 1995 (Cochrane, Childs, & Rosen, n.d.). At present, over 90% of the rice consumed is imported, predominantly from the US (International Trade Center - H 1006; estimates for 2023) **(Figure 26).**

Figure 26: Rice imports to Haiti by country, MT



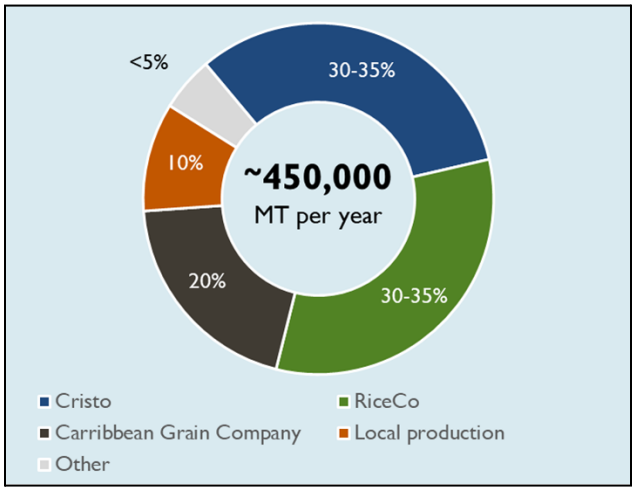
k, 1000; MT, Metric Ton

Imported rice is generally cheaper than domestically produced rice. Because of gang activity (which led to port blockades and the loss of multiple trucks by importers), rice imports have significantly decreased over the past year.

Main market players

Three large importers dominate the rice market in Haiti and account for most of the market, the rest being local production and a few small-scale importers **(Figure 27).**

Figure 27: Rice market estimate in Haiti by importers and local production, MT



The three main rice importers, all sourcing from the US, are:

- Cristo (30-35%)under the brands Bongu and Anita
- Caribbean Grain Company (20%) under the brand Mega
- RiceCo (30-35%) under the brands Bull, Tchako and Lolita

Local rice is commonly bought in large quantities from processors and then repackaged by resellers, including supermarkets. Producers/processors

occasionally form associations such as Konbit Latibonit, Fenaprih, Jaden Lakah, or Association des Producteurs de Moreaux Peigne (APMP). The primary locally produced rice varieties include Shella, Shelda, and white TCS-10.

Fortification
Haiti depends on rice exports from the US to fill its rice requirements. Rice fortification is mandatory in the US. However, it is unknown if the rice imported to Haiti is fortified. Moreover, rice fortification in the US uses dusting technology to fortify. Dusting technology is prone to micronutrient losses if the rice is washed prior to cooking or cooked in excess water. As 100% of the rice grown in the US is industrially milled, it would be feasible to fortify the exported rice. The WFP is currently assessing the opportunity to include imported fortified rice in its school-feeding programs.

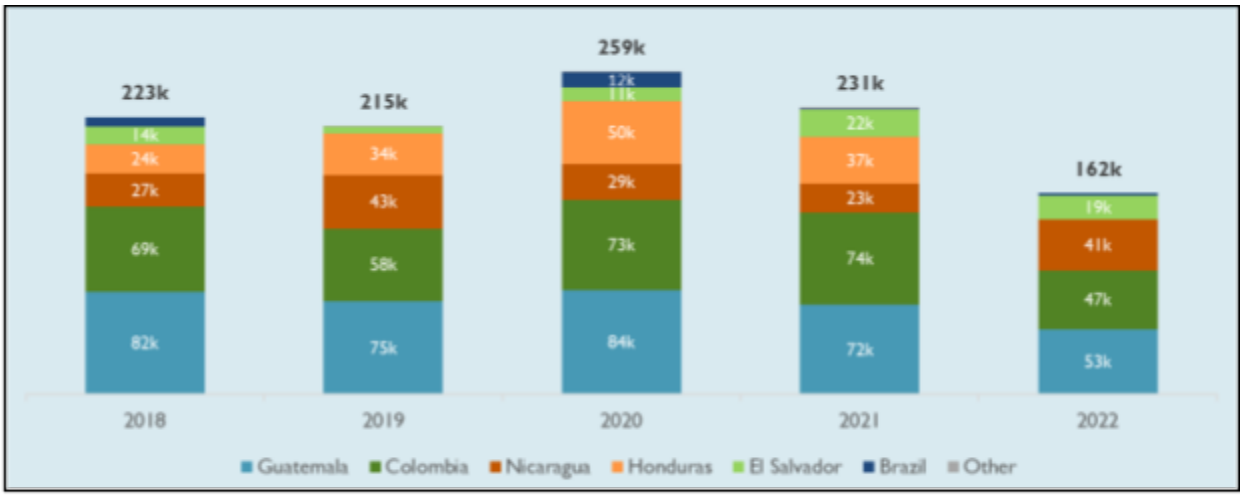
Sugar Industry

Overview
Haiti was nearly self-sufficient in sugar production prior to the 1980s. However, after the closure of the major processor Haiti American Sugar Company in 1987, the country experienced a significant shift towards massive sugar imports. Currently, there is very little local production of cane sugar in Haiti.

A type of brown unrefined sugar called 'rapadou' made from sugarcane juice is still being produced in small volumes in Haiti (also known by names such as "panela", "rapadura" or "galabé"). Historically, rapadou was produced using the leftover juice from the production of 'clairin,' a local Haitian alcohol. In 2010, the production of rapadou reached around 38,000 MT, manufactured by 2,100 factories in the country (AyiboPost, 2020). However, interviews reported that production has significantly declined since then.

Imports
Haiti imported 162,000 MT of sugar (i.e., 37 g/day per capita) in 2022 from different countries in the region (International Trade Center - HS 1701) **(Figure 28).**

Figure 28: Sugar imports to Haiti by country, MT

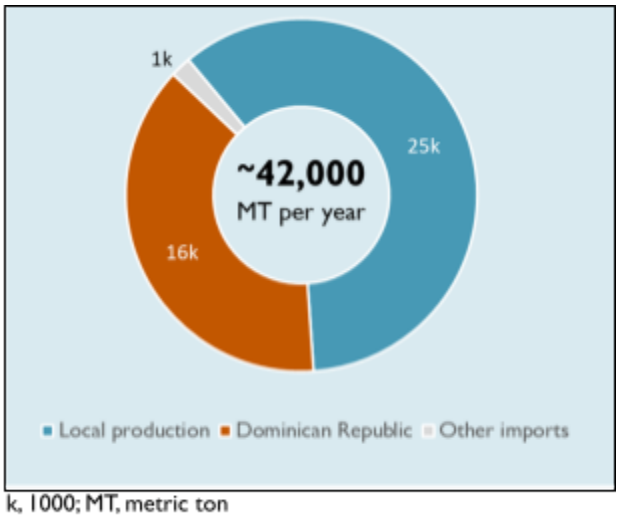


k, 1000; MT, Metric Ton

Of this quantity, 70% was in an unrefined form, while the remaining 30% was in a refined form. Guatemala (32.7%), Colombia (29%), and Nicaragua (25.3%) collectively contribute to over 85% of Haitian imports. Sugar from Colombia is predominantly raw, whereas sugar imported from Guatemala and Nicaragua consists of a blend of raw and refined sugars. While Guatemala and Nicaragua fortify their sugar with vitamin A, imports into Haiti are not labeled as fortified.

Pasta Industry

Figure 29: Pasta market share in Haiti, by origin, MT



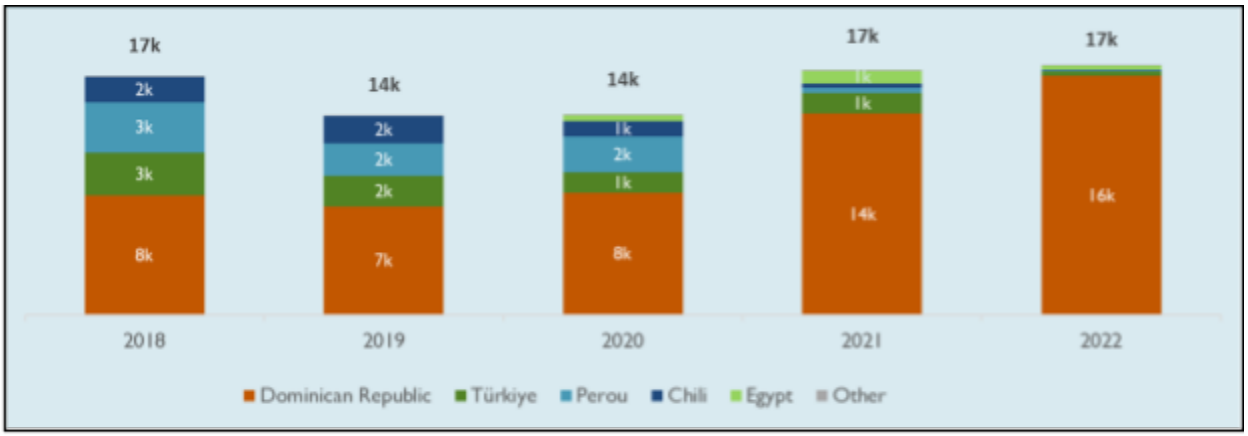
k, 1000; MT, metric ton

The Haitian market for pastas is estimated around 42,000 MT (i.e., 10 g/day per capita) **(Figure 29)**. The low intake of pasta indicates that pasta is not the main source of flour in the diet.

Several pasta brands are produced domestically. The largest processor is Caribbean Pasta S.A., which belongs to Groupe HM, the same owner as Caribbean Milling. They produce Pasta Mama. Cristo is their exclusive distributor throughout Haiti and for exports. They claim to have a significant production capacity, producing over 10,000 MT of pasta on a monthly basis (GROUPE HM, n.d.). Other locally produced brands include Gourmet and Itala.

The remaining consumption is reported to be imported. In 2022, 95% of Haitian pasta imports originated from the DOMR (International Trade Center HS 1902) **(Figure 30).**

Figure 30: Pasta imports to Haiti by country, MT

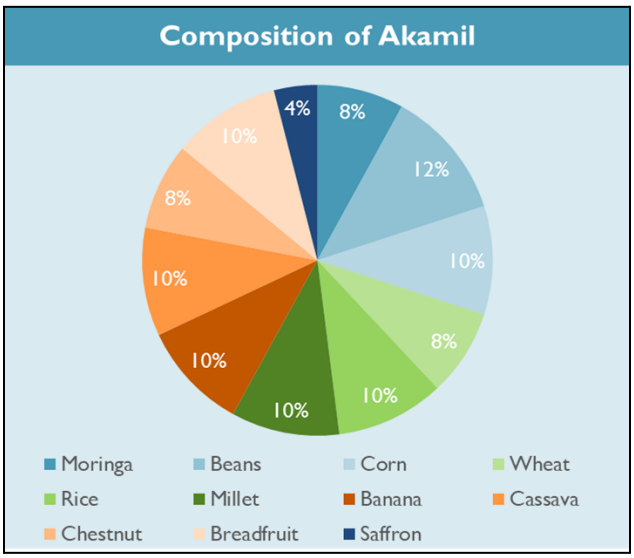


MT, Metric Ton

Several brands are produced outside of Haiti and repackaged locally, such as Lavagi, Vita, and Bongu. International brands can also be found, such as Panzani (France) and Barilla (US).

Akamil Industry

Figure 31: Ingredient composition of Akamil



Akamil (also known as Aka 1000) is a traditional Haitian dish commonly consumed during breakfast. It is a powder made up of a variety of ingredients and is mixed with water (Jean-Gilles HE Production) **(Figure 31).**

Field Ayiti reports to be the sole large processor of Akamil and began producing this powder in 2020. In 2022, Field Ayiti produced 12 MT of Akamil, most of which was sold to Action contre la Faim (Action Against Hunger) and Haitian hospitals. These products are primarily intended for programs targeting pregnant women, young children suffering from malnutrition, and people with Human Immunodeficiency Virus / Acquired Immunodeficiency Syndrome (HIV/AIDS). While there seem to be other processors (e.g. Jean-Gilles HE Production), there are no available data on their production volume.

Given that it is targeted to vulnerable populations, Akamil was designed to be a highly nutritious product, high in protein and with naturally occurring micronutrients such as vitamins A, B_1, B_2, E, magnesium, calcium, potassium, and zinc. As Field Ayiti was not able to provide a nutrient profile, it is unclear how Akamil contributes to micronutrient intake and whether fortification

would be of additional benefit. There is insufficient information on the use of Akamil and its potential impact on vulnerable population groups and the general population.

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International Trade Center HS 1701. n.d. Accessed September 8, 2023. https://www.trademap.org/Country_SelProductCountry_TS.aspx?nvpm=1%7c332%7c%7c%7c%7c1701%7c%7c%7c4%7c1%7c1%7c1%7c2%7c1%7c2%7c1%7c1%7c1.

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Part II: Food vehicle consumption and expected impact from LSFF

II.I Objective

The objective of accessing coverage, consumption and expected impact of LSFF based on different fortified food vehicle scenarios was to better understand the specific in-country dietary needs and gaps, identify optimal food vehicle reach, and assess best possible combinations of fortified foods and nutrients to improve the nutritional status of the target population, taking into consideration effective impact, effective coverage, cost implications, and safety.

II.II Methodology

Consumption methodology

As there are no dietary intake data available in Haiti, sources of daily caloric intake trends and proxy consumption data from came from various secondary data sources: country's 2012 Household Consumption and Expenditure Survey (HCES): Enquête sur les Conditions de Vie des Ménages Après le Séisme (ECVMAS); Food and Agriculture Organization (FAO) Food Balance Sheets; customs data from 2022; and industry estimates from the stakeholder interviews in 2023. None of these data sources report true dietary intake and are referred here as proxy consumption estimates.

As is further described below, HCES estimates are based on reported household food consumption and are representative of both national and sub-national estimates. Although these surveys are used primarily to provide information on poverty monitoring, the calculation of national accounts, and as an input for consumer price indices, based on existing research there is wide consensus that HCES, with carefully designed food purchase/use modules, are a valuable source of data for household-level food security and nutrition measurement (International Dietary Data Expansion Project, 2023).

FAO Food Balance sheet data represents national food availability; subnational estimates are not available. Food availability estimates account for local food production, milling/processing conversions, imports/exports, and losses due to seed, feed use, or waste at the food production stage. Waste at retail or consumer stage is not accounted for; thus food availability estimates are likely to be higher than actual dietary intake (FAO, 2023).

The customs data from 2022 and the industry estimates from 2023 were obtained by dividing the total market volume by the latest population data available from the Haitian Office of Statistics. Customs data were accessed using TradeMap, a tool developed by the International Trade Center that displays international trade statistics from UN Comtrade. Industry estimates were derived from interviews and triangulated with other available sources to ensure accuracy.

Dietary inadequacy and modeling methodology

The methodology used to assess dietary inadequacy and the contribution of existing (as of September 2020) and hypothetical LSFF programs to addressing the identified dietary gaps included a desk review and summation of previous modeling studies. To that end, findings from a September 2020 report, led by UCD in partnership with Global Alliance for Improved Nutrition (GAIN) and Partners of the Americas and subcontracted under the RANFOSE project, are summarized. The report is entitled: "Risk of micronutrient deficiency, and the predicted impacts, costs, and cost-effectiveness of existing and hypothetical micronutrient fortification programs among women and young children in Haiti" (Institute for Global Nutrition, 2020). Data in the study was collected from 2018-2019 and Haiti's most recent HCES, the ECVMAS 2012, was used to infer dietary inadequacy.

The ECVMAS survey, conducted by the Haitian Institute of Statistics and Information (IHSI) in 2012, employed a two-stage stratified cluster sample design, encompassing 4,951 households and ensuring representation at both national and administrative unit levels. Quantification of dietary inadequacy based on the ECVMAS data utilized the UCD Micronutrient Intervention Modeling Project (MINIMOD)-Secondary Data approach enabling the estimation of baseline nutrient intake and the prevalence of inadequate intake among specific demographic groups. Nutrients of focus included vitamin A, B_{12}, and zinc for children, and vitamin B_{12}, iron, and folate for WRA. The selection of demographic / micronutrient pairs was based on the severity of health consequences associated with each in Haiti at the time of analysis.

To estimate individual-level food consumption from household-level estimates, the adult male equivalent (AME) method (Weisell and Dop, 2012) was utilized. This method assumes food distribution within the household is proportional to each member's age- and sex-specific energy requirements. Each food item was matched with nutrient composition information from the University of Minnesota Nutrition Coordinating Center Food and Nutrient Database (Nutrition Coordinating Center, 2023).

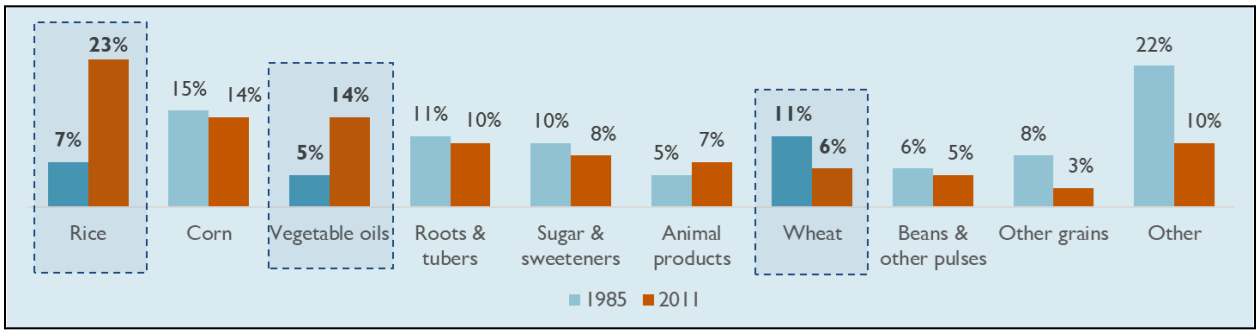
Following the dietary assessment, comprehensive modeling exercises were conducted to project the potential impact of fortifying both existing (refined edible oil and wheat flour) and hypothetical (bouillon and rice) food vehicles. Salt and iodine were not included since the micronutrients chosen were based on the severity of health consequences associated with each at the time of analysis. The modeling aimed to assess expected reductions in the prevalence of inadequate nutrient intake. Integral to the methodology were cost estimations, derived from diverse sources such as in-country collaborators, secondary data, and relevant literature on fortification program costs. These sources encompassed industry assessments, market analyses, supply catalogs, country assessments, and government wage data.

II.III Results

Overall consumption of staple foods

Profound trends have exerted a considerable impact on the consumption patterns of essential food items in Haiti. From 1985 to 2011, there has been a substantial increase in the daily caloric intake derived from rice and oil (Cochrane, Childs, and Rosen, n.d.) **(Figure 32).**

Figure 32: Change in daily caloric intake from food staples in Haiti, 1985 vs. 2011

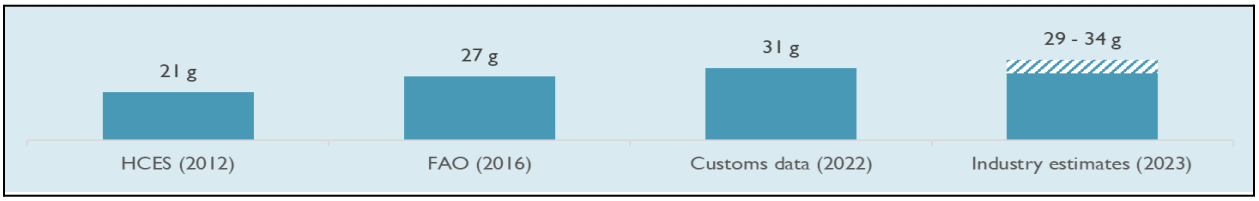


By 2011, rice constituted almost a quarter (23%) of the daily caloric intake for the Haitian population, marking a rise from the 7% reported a quarter-century earlier. The proportion of daily caloric intake from vegetable oils has surged by 11 percentage points during the same time span. Conversely, the consumption of wheat products has experienced a noticeable decline throughout this period.

This robust and enduring trend needs to be taken into account alongside a significant reduction in overall food consumption since the onset of the crisis in Haiti. This reduction has impacted both demand, as people's economic circumstances have worsened, making it difficult to afford food, and supply, as the port has been intermittently obstructed by criminal groups, causing food producers/processors and importers to incur repeated losses of trucks and boats loaded with food products. This decline over recent years is estimated to be approximately 30%.

National consumption estimates across food vehicles

Figure 33: Average oil consumption in Haiti, grams (g) per day per capita



HCES (2012) - HCES/ECVMAS - 2012
FAO (2016) - FAO/FEWS NET - Staple Food Market Fundamentals - March 2018
Customs data (2022) - International Trade Center
Industry estimates (2023) - based on market size, using population from the World Bank - Population as reference

Edible oil

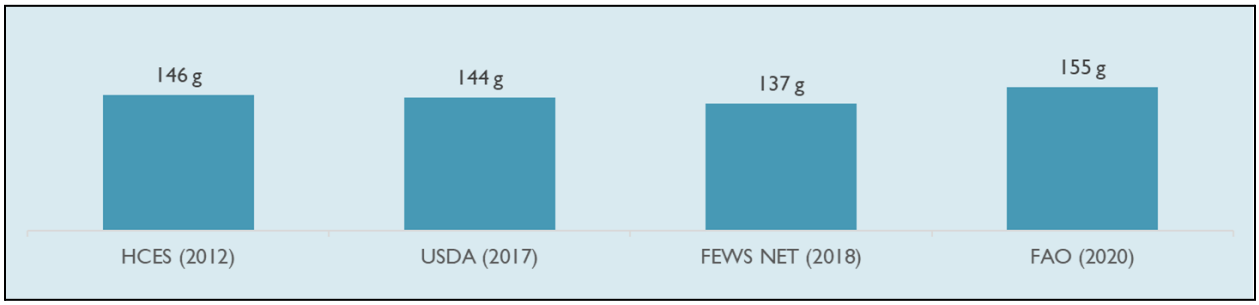
Edible oil is used in Haiti for preparing a variety of dishes, including fried foods, deep-fried foods, and snacks. Edible oil is usually not discarded but filtered and reused. Across multiple

different data sources, various proxy estimates of consumption indicate a range of 20-30 g/day per capita **(Figure 33).**

Rice

Rice is consumed in both rural and urban areas, often paired with beans and meats. In 1985, FAO recorded Haiti's rice supply per person at 36 g/day per capita, significantly lower than the 85 g/day per capita of corn and 258 g/day per capita of starchy roots, which have historically constituted the major portion of Haiti's food supply. The opening to imports in 1986 and low customs tariffs (3%) significantly increased its consumption. Rice is now the most consumed staple food in Haiti **(Figure 34)**.

Figure 34: Average rice consumption in Haiti, grams (g) per day per capita

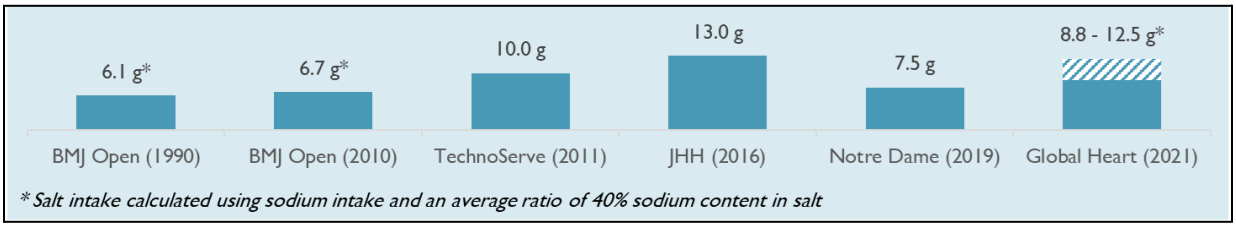


HCES (2012) - HCES/ECVMAS - 2012
USDA (2017) - USDA - Haiti - Grain & Feed 2018
FEWS NET (2018) - FAO/FEWS NET - Staple Food Market Fundamentals - March 2018
FAO (2020) - FAO - Food Supply Quantity - Rice, milled

Salt

Estimated salt consumption exceeds the World Health Organization (WHO) recommended intake amount of 5 g/day per capita; average salt consumption ranges between 7.5 and 13 g/day per capita **(Figure 35).**

Figure 35: Average salt consumption in Haiti, grams (g) per day per capita



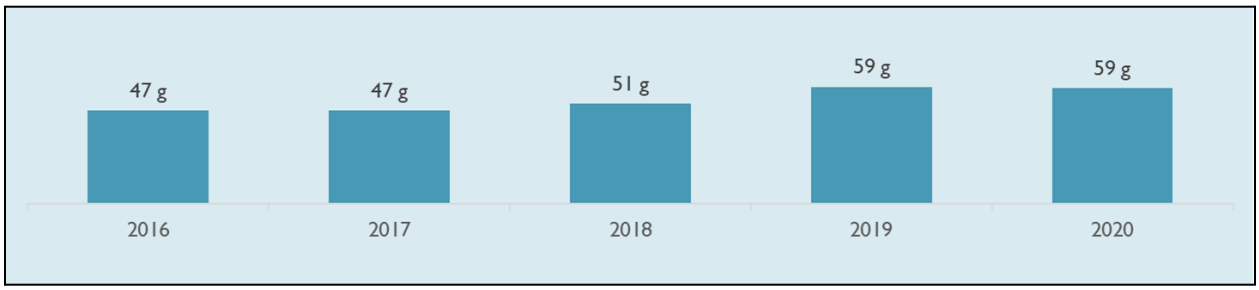
BMJ Open (1990) - Powles et al., 2013
BMJ Open (2010) - Powles et al., 2013
TechnoServe (2011) - USAID/Technoserve, 2011
JHH (2016) - Polsinelli et al., 2017
Notre Dame (2019) - Reimer et al., 2010
Global Heart (2021) - Clermont et al., 2023

Bouillon cubes account for a significant proportion of the salt intake, as they are composed of approximately 40-70% salt and are consumed daily. An estimated 1.22 g/day per capita of salt comes from bouillon cubes produced in Haiti. More than 66% of Haitians households report that they consume at least two cubes per meal (Barloggio et al., 2023).

Sugar

Haitians consume approximately 59g of sugar (raw equivalent) per day, mostly in the form of sugarcane **(Figure 36).**

Figure 36: Average sugar consumption in Haiti, grams (g) per day per capita

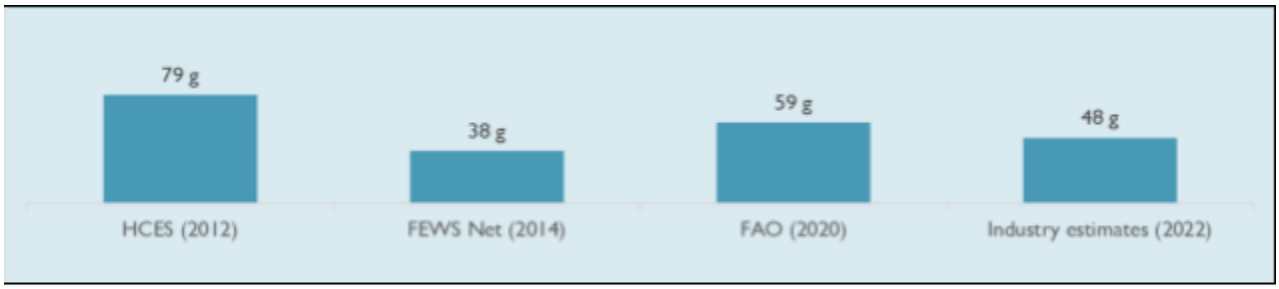


FAO - Food Supply Quantity - Sugar (Raw Equivalent)

Wheat flour

Despite relatively low consumption compared to rice, bread is easily found in bakeries across both rural and urban areas. Ambulant vendors also sell a wide variety of bread on the streets. In homes and restaurants, flour is also commonly used to make dumplings. These dumplings are long and have a similar appearance to plantains, often served alongside them in soups and pumpkin stews (bouyon). Other foods made using wheat flour include “pâté” and “marinade”. Industry estimates suggest consumption of approximately 48 g/day per capita of wheat flour **(Figure 37).**

Figure 37: Average wheat flour consumption in Haiti, grams (g) per day per capita



HCES (2012) - HCES/ECVMAS, 2012
FEWS Net (2014) - FAO/FEWS NET, 2018
FAO (2020) - FAO, 2020

Prevalence of apparent micronutrient inadequacy without LSFF

Based on diets alone, that is, without LSFF or other micronutrient interventions, household diets in Haiti are inadequate for all micronutrients assessed in both children aged 6-59 months and among women of reproductive age (vitamin A, iron, zinc, vitamin B12, and folate) **(Table X).**

Table 2: Inadequate Dietary Intake by MN without LSFF[1]

Micronutrient	Inadequate intake among children (6-59 months)	Inadequate intake among WRA
Vitamin A	93%	Data not analyzed
Iron	Data not analyzed	79% (100% in pregnant women)
Zinc	53%	Data not analyzed
Vitamin B_{12}[2]	95%	98%
Folate	Data not analyzed	50%

[1] No data available on vitamins B_1, B_2, or B_3
[2] Not included in any Haiti fortification standard

In general, it is reasonable to assume that when the prevalence of inadequacy is over 50%, it is a situation that warrants a public health strategy to help reduce inadequacy. For zinc, the International Zinc Nutrition Consultative Group (IZiNCG) has suggested categorizing zinc inadequacy as a public health problem when it exceeds 25% in the population (Hotz, 2007).

Following an understanding of dietary inadequacy, the impact of fortifying currently mandated (refined edible oil and wheat flour) and hypothetical (bouillon and rice) food vehicles on reductions in the prevalence of inadequate intake and predictions on impacts and cost-effectiveness were modeled. The term "*currently fortified*" refers to the fortification situation in Haiti as found by the RANFOSE study partners in 2020 including existing standards and assessed addition and / or compliance rates by industry as obtained from stakeholder discussions.

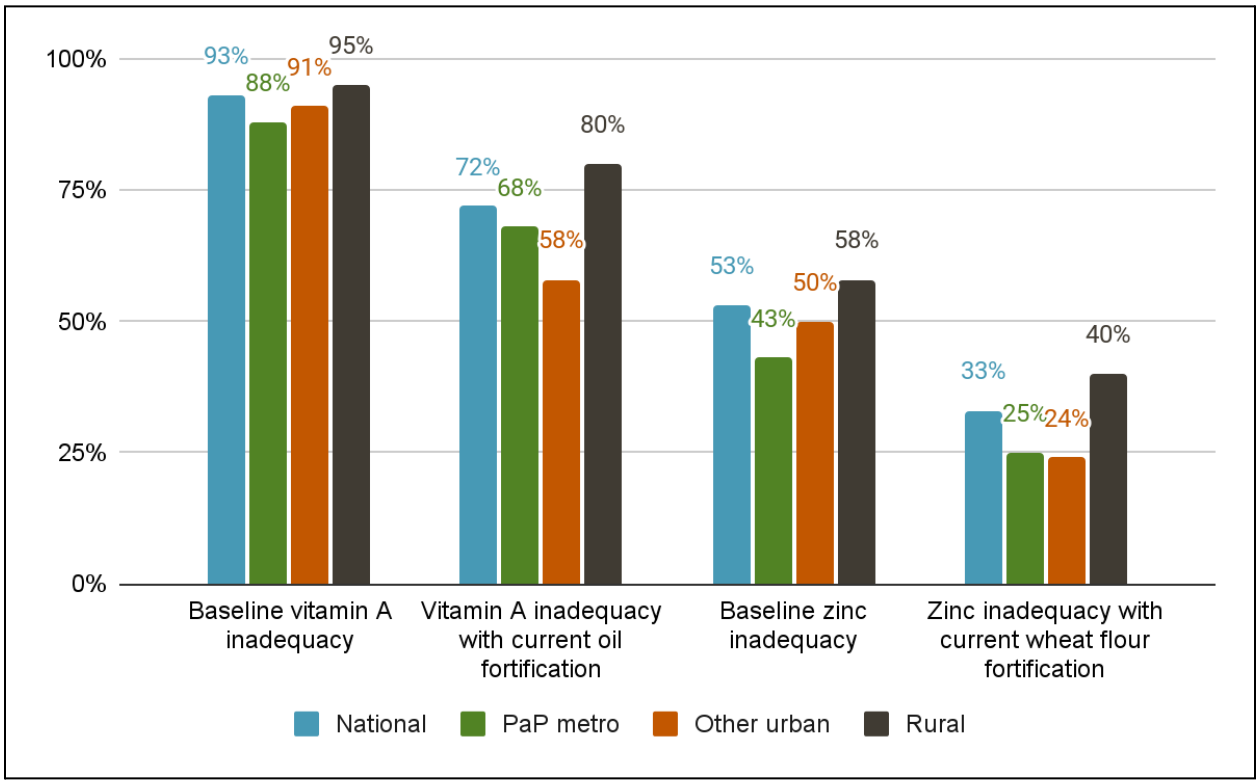
The modeling is predicated on a set of assumptions regarding percentage of the food that is fortified and percentage of fortified food vehicles that meet the draft national standards. Most assumptions are based on anecdotal reporting and personal communications with project staff which took place in 2020.

Contribution of existing and hypothetical LSFF scenarios to meeting micronutrient needs

Among children aged 6-59 months, under the current oil fortification scenario (defined as: 70% of oil fortified at an average addition rate of 10 mg/kg (RANFOSE interpretation of the draft levels for vitamin A fortification was 15.02 mg/kg)) the predicted prevalence of apparent

vitamin A inadequacy at the national level is reduced from 93% to 72%. Under the current wheat flour fortification scenario (defined as: 75% of wheat flour fortified at an average addition rate of 30 mg/kg (standard stipulates 60 mg/kg)), the predicted prevalence of apparent zinc inadequacy among children at the national level is reduced from 53% to 33% **(Figure 38).**

Figure 38: Current impact of LSFF on vitamin A[1] and zinc[2] inadequacies in children (6-59 mos)



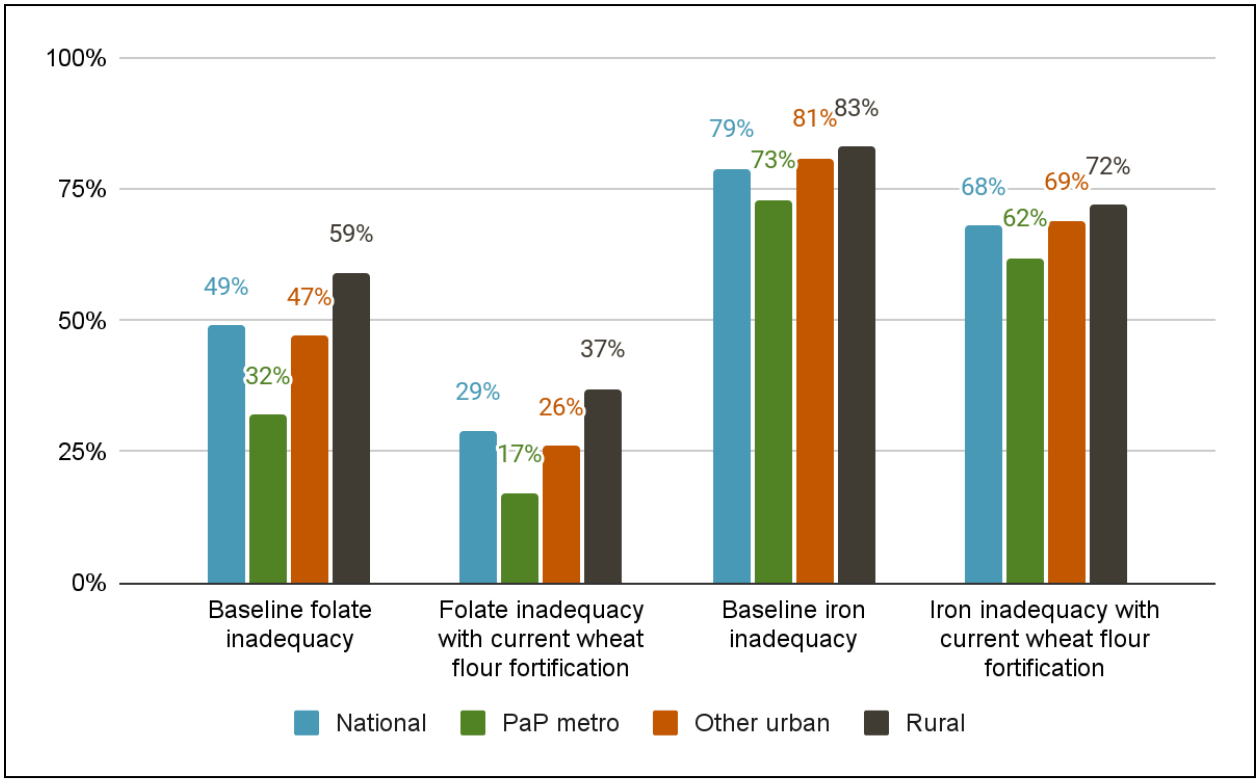
PaP metro, Port-au-Prince metropolitan area

[1] Vitamin A in oil: Reported 70% fortified at an average addition rate of 10 mg/kg (RANFOSE interpreted standard as 15.02mg/kg)

[2] Zinc in wheat flour: Reported 75% fortified at 30 mg/kg (standard stipulates 60 mg//kg)

Among WRA, under the current wheat flour fortification scenario (defined as: 75% fortified at an average addition rate of 1.5 mg/kg folic acid and at 30 mg/kg iron as Sodium iron (III) ethylenediaminetetraacetate (NaFeEDTA), the predicted prevalence of apparent folate inadequacy at the national level is reduced from 49% to 29%. The predicted prevalence of apparent iron inadequacy among WRA at the national level, is reduced from 79% to 68% **(Figure 39).**

Figure 39: Current impact of LSFF on folate and iron Inadequacies in WRA[1]



PaP metro, Port-au-Prince metropolitan area

[1] Folic acid and iron in wheat flour: Reported fortification level of 75% at 1.5mg/kg FA and 30 mg/kg as NaFeEDTA

Hypothetical models included an increase in the percentage of the food vehicle fortified as well as the addition of other vehicle / nutrient combinations. For example, improvements in the percentage of oil and wheat flour were modeled (assuming fortified oil would increase from 70% fortified to 90% fortified and wheat flour would increase from 75% fortified to 90% fortified).

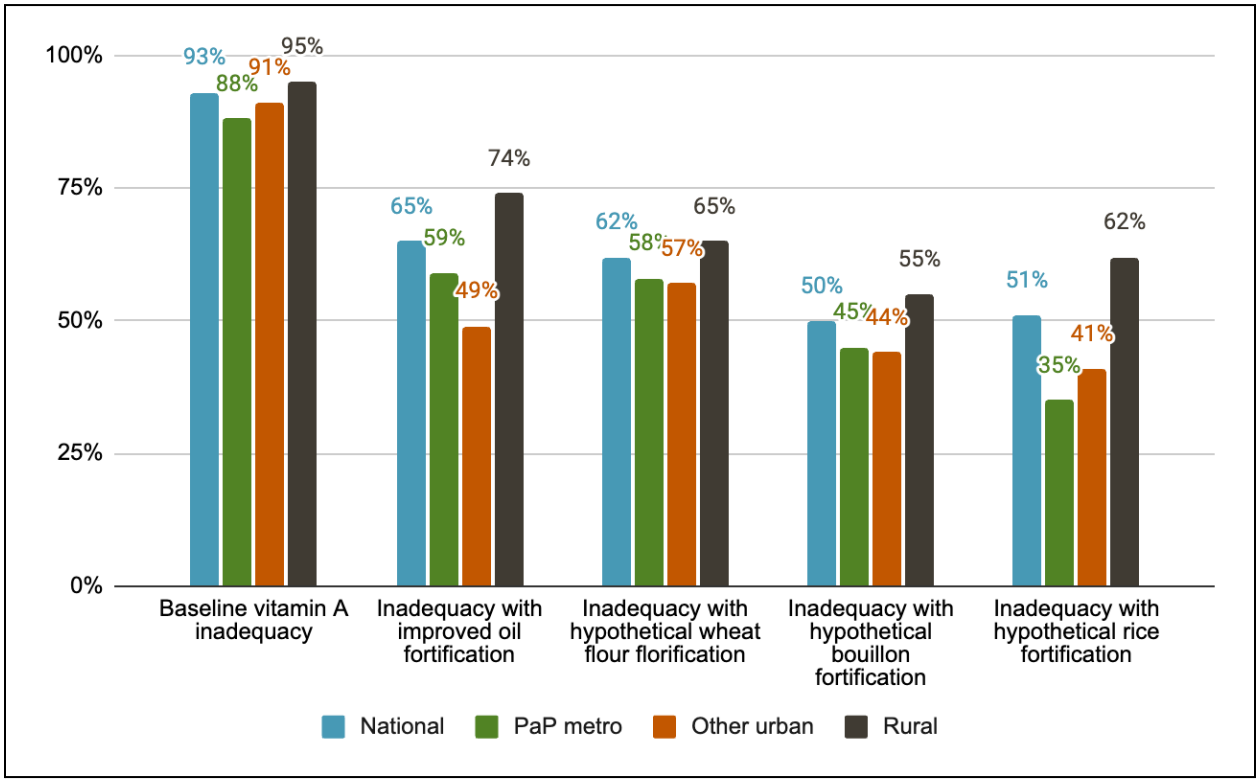
In consultation with RANFOSE, the authors of the study established 90% as the maximum level of fortification that would be realistically achievable, and assumed that it would take several years to reach the maximum. Specifically, over the 10-year time horizon, they assumed current levels of fortification in years 1-4, and the maximum levels of fortification in years 5-10. For bouillon and rice, the two hypothetical food vehicles, they modeled a single scenario. The assumptions underlying the bouillon and rice scenarios were arrived at in consultation with RANFOSE. Specifically, they assumed the food vehicles would not be fortified in years 1-2, would be fortified at 50% of target levels in years 3-4, and would be fortified at 90% of target levels in years 5-10.

Additionally, the addition of vitamin A, vitamin B_{12}, and zinc in bouillon cubes and rice and vitamin A and vitamin B_{12} in wheat flour were modeled.

Note that cost implications were considered in these initial scenarios and will be presented in the summary section below in order to provide greater context for what is realistic and feasible outside of the public health benefits of the modeled hypothetical scenarios.

Among children ages 6-59 months, improving oil fortification from 70% to 90% would decrease the predicted prevalence of apparent vitamin A inadequacy from 93% to 65% nationally (recall, with the current scenario it would decrease to 72%). Fortifying bouillon or rice alone would reduce vitamin A inadequacies among children to 50% and 51%, respectively. Across all hypothetical scenarios, vitamin A inadequacy remains relatively high at above 50% in rural populations, indicating that additional vitamin A interventions (e.g. fortifying an additional food vehicle with vitamin A or targeted supplementation) would be necessary to further lower vitamin A inadequacy, however careful attention will need to be paid to reaching the Upper Tolerable Intake Levels (UL) for vitamin A among children when combining different food vehicles fortified with vitamin A.

Figure 40: Apparent vitamin A inadequacy in children ages 6-59 months across various modeled LSFF scenarios

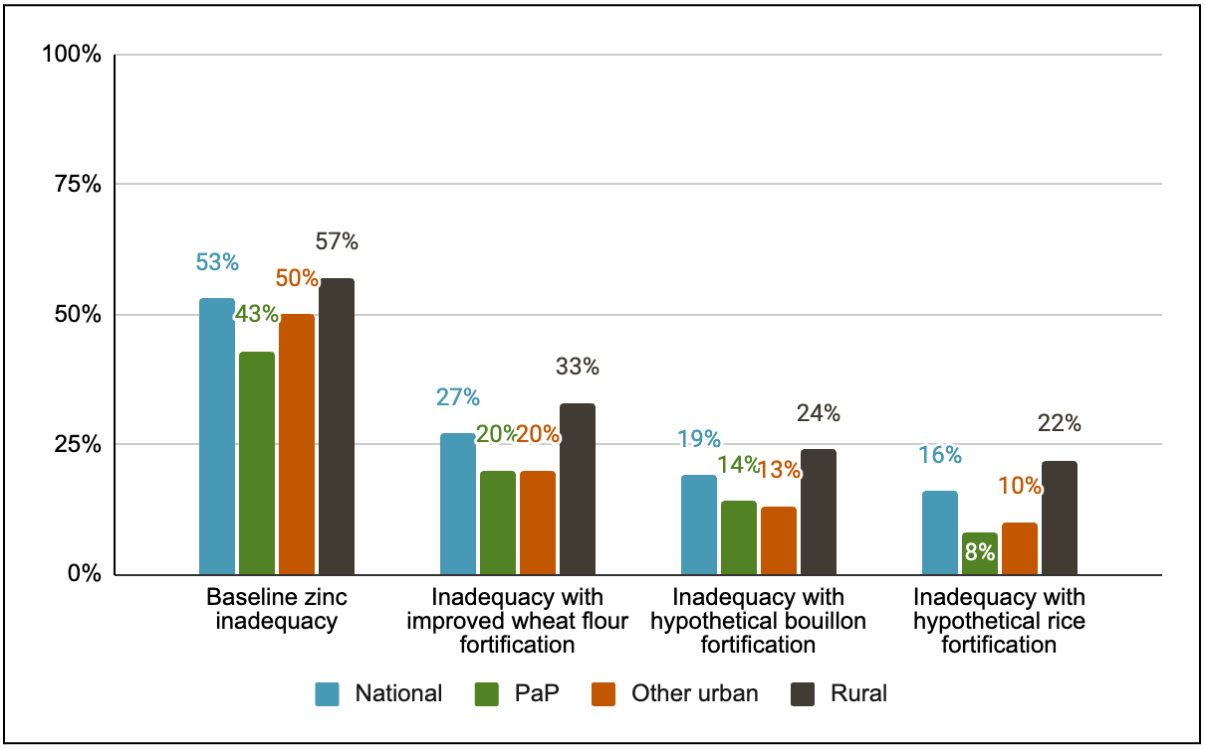


LSFF, large-scale food fortification; PaP metro, Port-au-Prince metropolitan area
[1] Improved oil fortification: elevating fortification to 90% at 15.02 mg/kg (RANFOSE identified addition level).
[2] Hypothetical vitamin A fortification scenarios: wheat flour (3 mg/kg), bouillon (200 mg/kg), and rice (3 mg/kg) assuming 90% is fortified.

Among children ages 6-59 months, improving wheat flour fortification from 75% to 90% would decrease the predicted prevalence of apparent zinc inadequacy nationally from 53% to 27% (recall, with the current scenario it would decrease to 33%), bringing it close to, but not under, the recommended IZiNCG cut-off of 25% to define a public health problem. Fortifying bouillon

or rice alone with zinc would each reduce inadequacies to 19% and 16%, respectively.

Figure 41: Apparent zinc inadequacy in children ages 6-59 months across various modeled LSFF scenarios



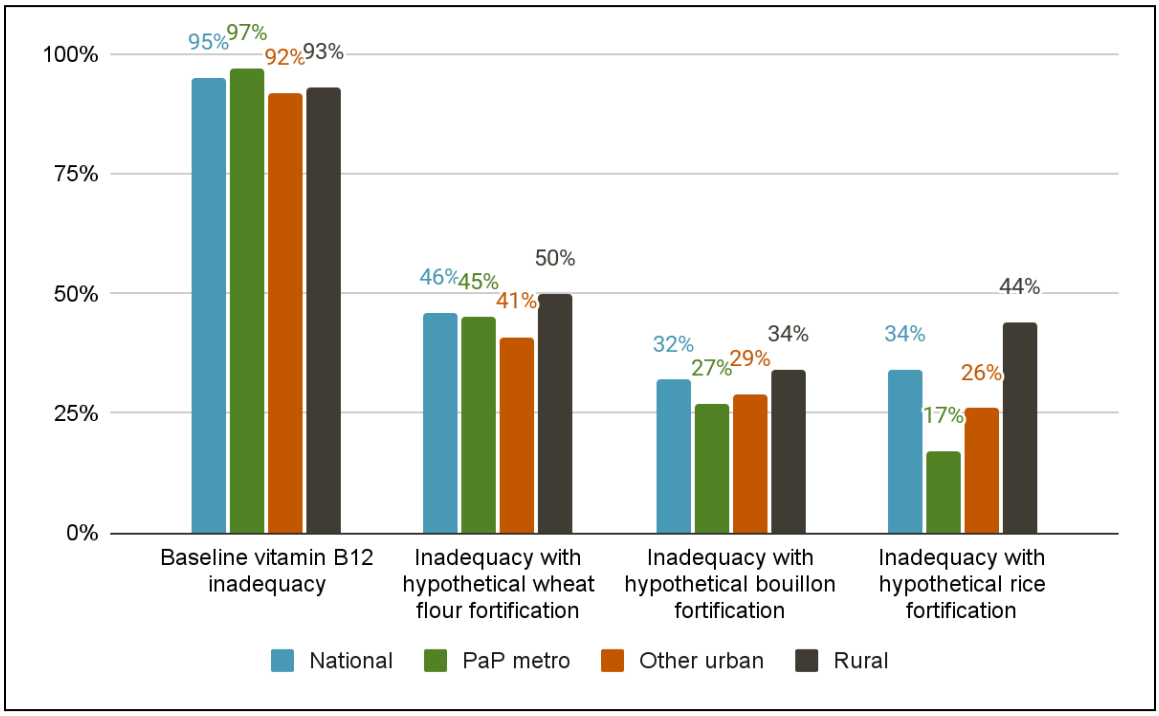
PaP metro: Port-au-Prince metropolitan area
Improved wheat flour fortification: increasing the percentage fortified to 90%, with a standard of 60 mg/kg (current standard).
Hypothetical fortification envisions the addition of zinc to bouillon (3,000 mg/kg), and rice (80 mg/kg) at a compliance level of 90%

Contribution of LSFF to meeting micronutrient needs: vitamin B_{12}

Vitamin B_{12} is not currently included in any fortification standard in Haiti despite inadequacy being high among children and WRA. The hypothetical scenarios presented below explore the potential reduction in vitamin B_{12} inadequacies among children ages 6-59 months and WRA if 90% of the wheat flour, bouillon or rice were fortified with vitamin B_{12}. For children, with the addition of vitamin B_{12} to wheat flour alone, inadequacy at the national level could decrease from 95% to 46%. Compared to wheat flour, fortifying bouillon or rice alone would lead to a greater drop in inadequacy, from 95% to 32% and 34% respectively.

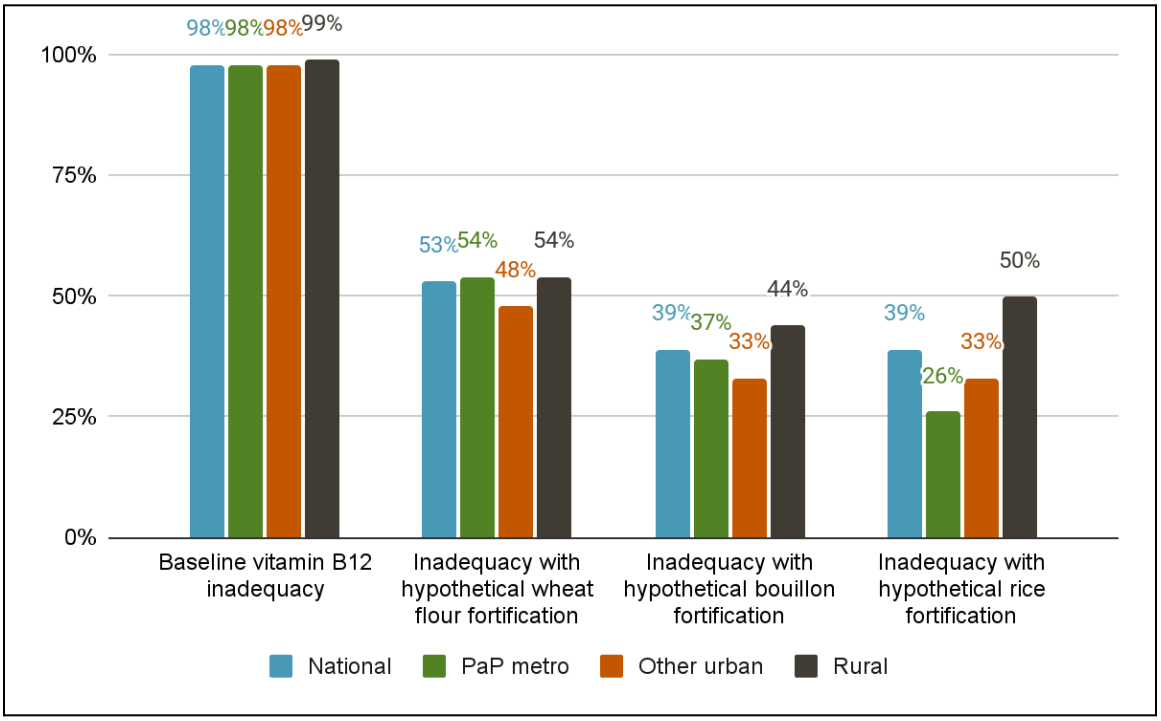
For WRA, vitamin B_{12} inadequacy could decrease from 98% to 53% with the addition of vitamin B_{12} to wheat flour and 39% with the addition of B_{12} to bouillon or rice **(Figure 42)**.

Figure 42: Apparent vitamin B_{12} inadequacy in children (6-59 mos) across various modeled LSFF scenarios



PaP metro: Port-au-Prince metropolitan area
Hypothetical fortification: addition of vitamin B_{12} to wheat flour (0.02 mg/kg), bouillon (1.2 mg/kg), or rice (0.02 mg/kg) at 90% compliance

Figure 43: Apparent vitamin B_{12} inadequacy in WRA across various modeled LSFF scenarios[1]

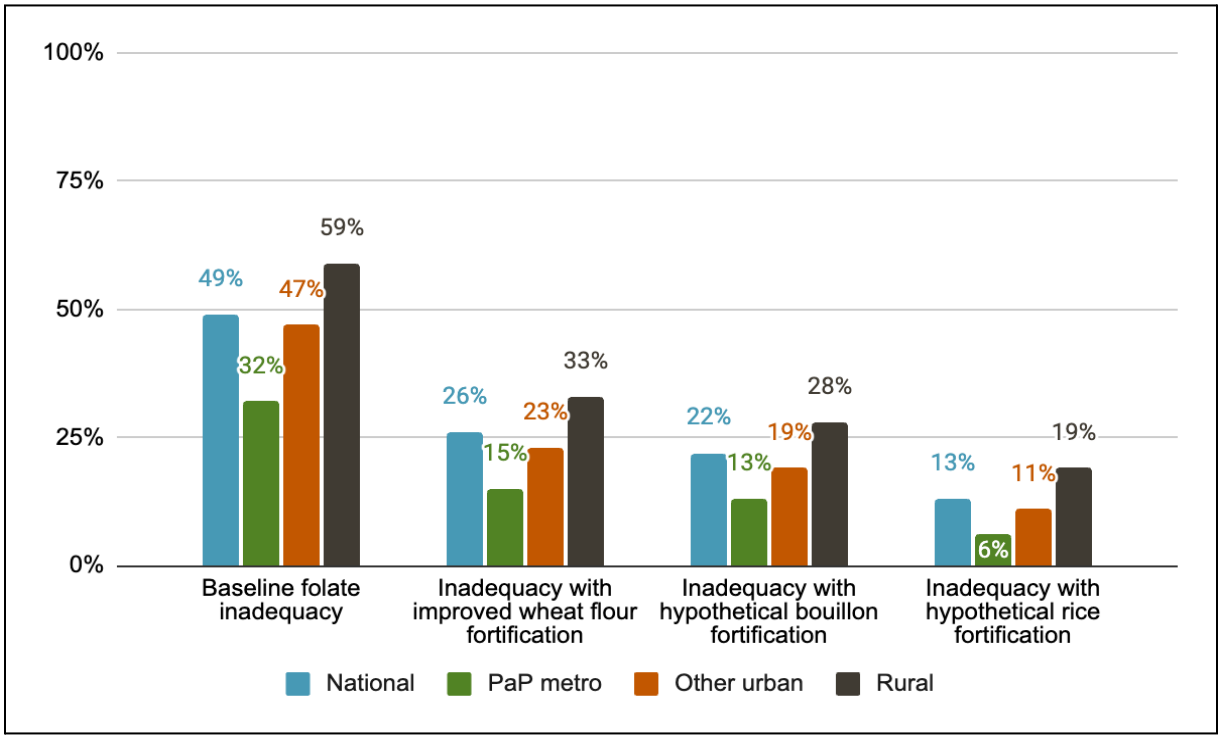


PaP metro,Port-au-Prince metropolitan area
[1] Hypothetical fortification: addition of vitamin B_{12} to wheat flour (0.02 mg/kg), bouillon (1.2 mg/kg), or rice (0.02 mg/kg) at 90% fortified

Contribution of LSFF to meeting micronutrient needs: folic acid

Among WRA age, improving wheat flour fortification from 75% to 90% would decrease the predicted prevalence of apparent folate inadequacy nationally from 49% to 26%. Fortifying bouillon or rice alone would each reduce inadequacies to 22% and 13%, respectively.

Figure 44: Apparent folate inadequacy in WRA across various modeled LSFF scenarios [1,2]



PaP metro, Port-au-Prince metropolitan area

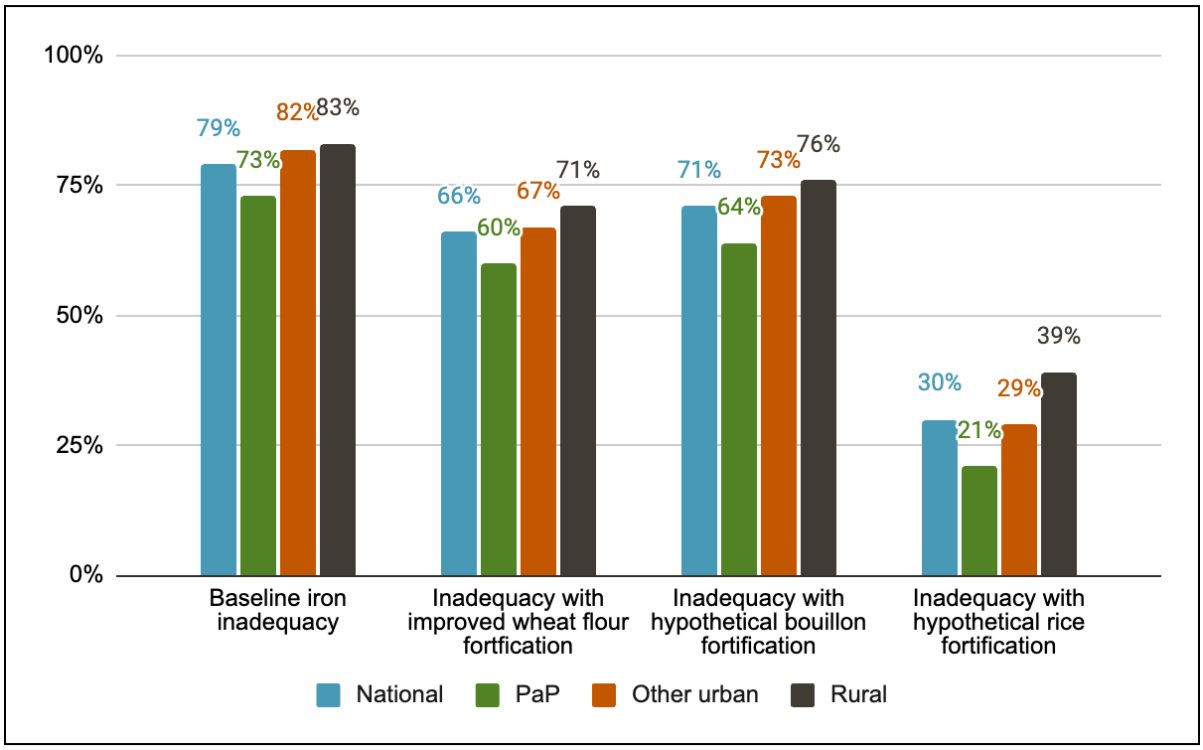
[1] Improved wheat flour fortification: elevating the compliance of fortification to 90% (1.5 mg/kg (current standard)

[2] Hypothetical fortification with folic acid: bouillon (80 mg/kg), and rice (2.6 mg/kg) at a compliance level of 90%

Contribution of LSFF to meeting micronutrient needs: zinc

Among WRA, improving wheat flour fortification from 75% to 90% would decrease the predicted prevalence of apparent zinc inadequacy nationally from 79% to 66%. Additionally, fortifying bouillon and rice alone would each reduce inadequacies to 71% and 30%, respectively.

Figure 45: Apparent iron inadequacy in WRA across various modeled LSFF scenarios [1,2]



PaP metro, Port-au-Prince metropolitan area

[1] Improved wheat flour fortification with iron: elevating fortification compliance to 90% (30 mg/kg)

[2] Hypothetical iron fortification: bouillon (4,000 mg/kg) and rice (120 mg/kg) at a compliance level of 90%

Public Health and Cost-Effectiveness Analysis Program Implications

Current draft fortification standards in Haiti have the potential to make an impact on dietary inadequacies among children and WRA (despite relatively low consumption levels of some vehicles, e.g., wheat flour). However, there is room for improvement based on current rates of dietary inadequacy nationally and across key demographic groups. It should also be noted that the current draft fortification standards are not all aligned with WHO guidelines (Table 3 below). Some of this is dependent on which consumption figures are referenced while others are not. Since no hypothetical scenarios were run on how improved standards would contribute to dietary inadequacies, this represents an important area of work that should be assessed before standards are officially mandated.

The results at national level indicate that each of the food vehicles considered (wheat flour, bouillon cube, edible oils, and rice) would reach a high percentage (>90%) of the population, but the predicted cost-effectiveness for achieving adequate dietary intake varied among foods, from less than US$ 1 to more than US$ 20 per individual effectively covered (i.e., per individual who achieves adequate apparent intake thanks to the intervention program) (summarized data not shown). The most cost-effective scenarios are included below, however, caution should be taken in their interpretation as they are hypothetical scenarios, which would have to be considered in light of further technical, organoleptic, and industry feasibility limitations and

considerations (e.g., the feasibility of including so many additional nutrients in bouillon and their respective bioavailability) as well as the realities of meeting these requirements within Haiti.

- The most cost-effective combination of vitamin A fortified foods was oil and bouillon cubes ($2.25/child-year effectively covered). This combination would also cover more children than either food vehicle alone. Inadequate intake would drop from 93% to ~26%.
- Zinc in bouillon cubes proved the most cost-effective ($1.25/child year effectively covered). Zinc in rice and bouillon cubes would bring inadequacy from 53% to between 16-19% in children, respectively. Improvements in wheat flour compliance would bring it from 53% to 27%.
- For both children and WRA, vitamin B_{12} in bouillon cubes was the most cost-effective ($0.95/child-yr effectively covered and $0.35 per WRA-yr) bringing inadequate intake among kids and WRA down from 95% and 98% to 31% and ~39%, respectively. Adding B_{12} to wheat flour would have a smaller, but still significant impact (WRA: 98% to 53%; children: 95% to 46%).
- The most cost-effective vehicle for delivering folic acid to WRA was bouillon cubes ($0.24/WRA-yr effectively covered) bringing prevalence from 49% to 22%. Combining wheat flour and bouillon was estimated to bring it down further to ~13% at a cost of ($1.82/WRA-yr)
- Iron in wheat flour proved to be most cost-effective and would reduce inadequacy from 79% to 66%. Although the biggest improvements in iron inadequacy among WRA could be seen by adding iron to rice (79% to 30%), its high cost meant it was not cost-effective compared to wheat flour. Large improvements could be seen with bouillon, however, estimated absorption of iron from fortified bouillon is low, thus lower effective coverage.
- Pasta was not independently modeled as a food vehicle. It was presumed that the modeling exercise for wheat flour included wheat flour used in the production of pasta. Independently, pasta is not considered a candidate for food fortification because of low estimated intake (~10g/day per capita).

Upper Intake Limitations

Reaching the upper tolerable limit for children and women will need to be carefully considered under any combined food vehicle scenario. Pages 100-108 of the RANFOSE report should be consulted for these specific findings. Pertinent examples are provided below:

- Among children, fortifying 90% of wheat flour with zinc to standard could lead to ~21% exceeding the UL for zinc, in contrast to ~9% under current fortification. Furthermore, assuming fortification of bouillon or rice, the percentage of children with zinc intake above the UL could rise to ~36% and ~24% respectively. Combining different scenarios of wheat flour, bouillon, and rice with zinc would cause between ~40-70% of children to reach UL for zinc.

- In children, fortifying oil with vitamin A up to 90% target levels could lead to ~0.5% exceeding the UL, in contrast to the current fortification level, where 0% of the population exceeds the UL. Furthermore, assuming fortification of bouillon or rice alone, the percentage of children with vitamin A intake above the UL could increase to ~3% for bouillon and ~0.7% for rice.
- For WRA, the introduction of fortified rice at 90% of target levels might result in iron intake above the UL reaching ~10%. Combining different scenarios of wheat flour, bouillon, and rice with iron would cause a potential ~5-25% of WRA to reach the UL for iron.
- Reaching the folic acid UL for WRA only became an issue with the combination of wheat flour and rice; bouillon and rice; and wheat flour, rice, and boullion were considered. The proportion of the population exceeding the UL ranged between ~5-20%.
- No UL concerns were found for children or WRA under any vitamin B_{12} combined fortification scenario.

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Part III: Enabling environment desk review

III.I Objective

The objective of the enabling environment assessment was to identify the key stakeholders in LSFF, the respective roles and responsibilities, and the legislative framework for food fortification.

III.II Methodology

The enabling environment desk review utilized the same methodology described in section I.II Methodology.

III.III Results

LSFF policies & standards

Legislation

The fortification of salt, wheat flour, and oil became mandatory in 2017 as specified in the *Loi portant sur la Fortification des Aliments en Micronutriments*. USAID RANFOSE played a crucial role in advocating for this legislation with the government.

The 2017 legislation does not specify the standards to be used, which were expected to be determined by the Council of Ministers based on recommendations from the MSPP and the Ministry of Agriculture.

Standards

The MSPP, with the support from RANFOSE, drafted standards **(Table 3)**, and regulatory monitoring processes, but these measures never officially passed. The reasons behind the non-enforcement of these measures are unclear, but it is likely that other topics (security, education, etc.) were prioritized by the government. It has also been six years without any general elections, deputy terms have also come to an end and the prime minister focuses on handling daily affairs. As of January 2023, there is no functioning parliament and no officials remaining to handle business such as passing new standards. However, because the prime minister also has the power to pass standards by decree, advocacy efforts continue.

Even though they have never been officially voted on, where food processors report fortifying their products, they refer to the nutrients and levels specified in the draft version of the standards. As mentioned in the introduction of this report, the draft standards are not clearly written, which may lead to differing interpretations of the required nutrient addition levels - particularly for vitamin A and iodine.

Table 3: Mandatory fortification and draft standards in Haiti compared to WHO guidelines

Food vehicle	Year[1]	Legislation scope	Current draft standard[2]	Comparison with WHO Guidelines[3,4]	
Salt	2017	All salt	Iodine: 40 ±10 mg/kg (33.7 to 67.5mg of KIO_3)	Draft standard is appropriate for ~5 g/c/d of salt intake. Haiti's estimate ranges from 6-13 g/c/d.	
Oil (edible)	2017	All edible oil	Vitamin A: 5.25-6.9mg RE/kg	N/A; no WHO guidelines for oil fortification.	
Wheat flour	2017	All wheat flour	Iron: 30 mg/kg (NaFeDTA) Folic Acid: 1.5 mg/kg Zinc: 60 mg/kg Vitamin B_1: 5.4 mg/kg Vitamin B_2: 3.6 mg/kg Vitamin B_3: 40 mg/kg	<75 g/c/d	75-149 g/c/d
				40 mg/kg[5] (NaFeEDTA) 5 mg/kg[5] 90 mg/kg[5] 3 mg/kg[6] 2 mg/kg[6] 40 mg/kg	40 mg/kg[5] (NaFeEDTA) 2.6 mg/kg[5] 55 mg/kg[6] 3 mg/kg[6] 2 mg/kg[6] 40 mg/kg

Abbreviations: mg/kg, milligram per kilogram; ppm, parts per million; RE, Retinol Equivalent; WHO, World Health Organization
[1] Year of legislation. Implementation year may differ.
[2] These standards are likely to be based on consumption data from 2012.
[3] WHO. Guideline: fortification of food-grade salt with iodine for the prevention and control of iodine deficiency disorders. Geneva: World Health Organization; 2014.
[4] Guideline: fortification of wheat flour with vitamins and minerals as a public health strategy. Geneva: World Health Organization; 2022. License: CC BY-NC-SA 3.0 IGO.
[5] Indicates draft standard is under the WHO recommendations
[6] Indicates draft standard exceeds the WHO recommendations

Alignment with WHO guidelines for food fortification

A comparison of the draft standards in Haiti with where WHO guidelines foods exist is in **Table 3**. Even though across multiple sources **(Figure 3)**, the salt consumption estimates vary widely between 6-13 gday per capita, at 40 mg/kg, the iodization standard is more appropriate for consumption closer to 5 g/day per capita.

Alignment with wheat flour fortification guidelines is slightly more complicated, as the various estimated wheat flour consumption **(Figure 27)** in Haiti straddles two consumption categories: <75 g/c/d and 75-149 g/c/d. Under either consumption category, the iron fortification is 25% lower than recommended by WHO; folic acid fortification levels are under both scenarios, either 70% or 42% lower than the WHO recommendation. Zinc, on the other hand, may be appropriate depending if consumption is in the higher category of consumption. WHO guidelines also provide restitution levels (which are the same across consumption categories) for vitamins B_1, B_2, and B_3; in the cases of B_1 and B_2, the draft standards are higher than restitution. Although this is the case, neither B_1 or B_2 have established upper tolerable limits.

Coordination & regulatory monitoring

Public stakeholders

Three distinct ministries cooperate to monitor food fortification in Haiti:

- The MSPP develops the strategy to address malnutrition, establishes fortification standards, and operates a laboratory (Laboratory Veterinaire et de Controle Qualité des Aliments de Tamarinier) able to conduct food testing. However, at the time of the USAID AFFORD Assessment this lab was not operational. It was being moved to a new location and waiting for external technical support for the installation of some equipment (e.g. HPLC); this was on hold due to the pending security situation. The future fortification committee, to be formed upon the approval of standards, will fall under the MSPP's jurisdiction.
- The MARNDR plays a role due to the local production of certain food vehicles, notably salt. The CNSA is also attached to this ministry.
- The Ministry of Commerce and Industry (MCI) oversees the Bureau des Normalisations, responsible for setting norms. The MCI also plays a crucial role in monitoring imports, as certain products will need to undergo testing before being customs clearance.

Regulatory monitoring

Since the text has not been officially voted on, there are no regulatory monitoring mechanisms in place, nor are there any fines for food processors that chose not to comply with the draft regulation. So far, fortification has mostly depended on processors' willingness to fortify their products.

Conclusions

Modeled food fortification scenarios for rice, oil, and wheat flour suggest that significant reductions in micronutrient inadequacies could be addressed if fortification were effectively implemented and/or if additional nutrients were added to these vehicles (e.g., vitamin$_{B12}$ to wheat flour). Multiple nutrient fortification of bouillon (with nutrients beyond iodine) could hypothetically also reduce micronutrient inadequacies. At this time, the direct fortification of bouillon with multiple micronutrients (compared to the use of iodized salt as an ingredient) is still being explored by researchers from an efficacy standpoint and its commercial feasibility is undetermined.

Several food vehicles are feasible to fortify from a technical standpoint, as they are industrially produced either locally or abroad. Wheat flour is the only food that is primarily locally and industrially processed and there is evidence that the three local wheat flour millers are not fully fortifying their products. The rest of the foods (where industrially processed) are primarily imported (edible oil, rice, and salt) and thus rely on compliant fortification at the point of origin. Oil imported by companies other than the major three Haitian importers is not being fortified; as a result, nearly a third of the oil market is considered non-fortified. An estimated 79% of the salt in Haiti is not fortified. Iodized salt is primarily imported, with a minority coming from domestic producers. This finding confirms that the salt iodization program is failing in the country despite more than 30 years of efforts to improve this program. However, subnational data from 2022 suggests that the use of locally and imported iodized salt in bouillon cubes has improved iodine status in an area that was previously inadequate in a 2016 national survey. It is unknown whether this effect is nationally generalizable or whether there are subpopulations that are still at risk of iodine deficiency disorders.

Locally produced pasta may use fortified ingredients (wheat flour and salt) in production, but the low intake of this product by the Haitian population suggests that the dietary contribution will be low. General population consumption of Akamil (a targeted complementary food for vulnerable population groups), was not available and thus it was not possible to comment on the utility of fortifying Akamil for public health benefit.

Although multiple foods are industrially produced, the greater implementation barrier for mandatory food fortification in Haiti is the enabling environment, which lacks two major elements: clear and approved standards to guide industry fortification and a functional regulatory monitoring system given existing food insecurity and political instability.

Annex 1: Stakeholders interviewed

Organization	Contact name	Title / Position held
Government entities		
Bureau Haïtien de Normalisation	Monorde Civil	Director
Ministère de l'Agriculture, des Ressources Naturelles et du Développement Rural	Philippe Mathieu	Former Minister
Ministère de l'Agriculture, des Ressources Naturelles et du Développement Rural	Ronel Thelusmond	Director of the technical division of the National Institute for the Application of Agrarian Reform
Ministère de la Santé Publique et de la Population	Joseline Marhone Pierre	Director of the Unité de Coordination du Programme National de Nutrition
Private sector companies and associations		
Bon Sel Dayiti (The Bon Sel Initiative)	James Reimer	Director
Caribbean Milling	Wislande Sideus	Quality Manager
Carribex	David Brandt	Chief Executive Officer
Carribex	Carl-Henri Cenafils	Quality Control Manager
Les Céréales d'Haïti	Claude Marcel Grand-Pierre	Chief Executive Officer
Les Entreprise Charles Jumelles S.A	Louis Laurent Jumelle	Manager
Field Ayiti	Maxime Pierre	Chief Executive Officer
Milien Production	Milien Merove	General Manager
Molinos Modernos	Eduardo Lopez Garrido	Sales Manager
Rebo	Antoine Levelt	General Manager
RiceCo	Jean-Michel Chérubin	General Manager
Salt Producer	Ryslin Eugen	Manager

SIPAL (TopCo)	Lucien Rousseau	Chief Executive Officer
International institutions		
Partners of America / USAID RANFOSE	Yves-Laurent Régis	Chief of Party
World Food Program	Myrlande Norelia	Nutrition Specialist
World Food Program	Chiara Catenazzi	Nutrition Officer