2023 Annual Report

BUILDING MOMENTUM AND PARTNERSHIPS FOR A FORTIFIED FUTURE

Food Fortification Initiative
Enhancing Grains for Healthier Lives

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Photo: Two women clean rice in Thiagar, Senegal. (Xaume Olleros/RTI)
Cover photo: Xaume Olleros/RTI

The Food Fortification Initiative (FFI) champions effective grain fortification so people have the nutrition they need to be smarter, stronger, and healthier.

FFI provides unique expertise to help country leaders plan, implement, and monitor the fortification of industrially milled cereal grains. Established in 2002, we are a public, private, and civic partnership based at Emory University.

What is fortification?

Food fortification—sometimes referred to as food enrichment—is when food producers add essential vitamins and minerals missing in a population's diet to food that people eat every day.

Humans need vitamins and minerals, called micronutrients, in small amounts to function optimally. The consequences of micronutrient deficiencies can be extensive, including devastating birth defects for babies, maternal death, impaired brain development in young children, and reduced work capacity among adults.

Large-scale food fortification is a proven, cost-effective way to prevent micronutrient deficiencies, save lives, and build a better future.

Visit our website **FFInetwork.org**

Photo: Thomas Cristofoletti Ruaro/RTI

Message from the Director

Dear Partners and Colleagues,

As I look back on 2023, it is evident that the year was a milestone in our global efforts to ensure that essential nutrients reach the people who need them most. The momentum in our shared mission to advance food fortification has been both inspiring and transformative. Across the world, we are seeing progress like never before, driven by collaboration, innovation, and a shared commitment to change.

The unanimous passage of the 2023 World Health Assembly resolution on food fortification stands out as a major achievement. This resolution is a global commitment to use food fortification as a powerful public health strategy to combat malnutrition. It reflects a growing recognition of the crucial role that fortified foods play in improving health outcomes, particularly for women and children who are most vulnerable to nutrient deficiencies.

We have also seen substantial investments in food fortification and expansions in partnerships. USAID's commitment through the USAID Advancing Food Fortification to Reinforce Diets (AFFORD) project represents a significant boost for our efforts, especially in building tools that will help countries build effective, sustainable fortification programs. This investment is not just about providing resources; it's about creating lasting change by ensuring that more people have access to nutrient-rich foods that can improve health and well-being.

FFI's collaboration with UNICEF is making strides across Africa and Eastern Europe, strengthening local fortification programs to reach more communities. In India, our partnership with the Rockefeller Foundation is advancing fortification in a country where addressing malnutrition is critical to the nation's future and where providing fortified foods through social protection programs can reach hundreds of millions of the country's most vulnerable.

We are also grateful for the unwavering support of our Executive Management Team (EMT) members, including our newest member, Ardent Mills. Their commitment underscores the growing recognition of large-scale food fortification as an effective, safe, and high-impact intervention to transform lives.

Our work is gaining visibility and recognition beyond the fortification community circle. An article in *The Economist* recently highlighted the importance of large-scale food fortification and how small investments in nutrition can transform not only the potential of tomorrow but also the well-being of generations to come. It is a powerful reminder that our work is about shaping futures.

This is a pivotal moment for our work. With your and our partners' continued support, we are poised to achieve even greater success in 2024. Together, we are building a world where everyone has the nutrients they need to thrive.
With gratitude and hope,

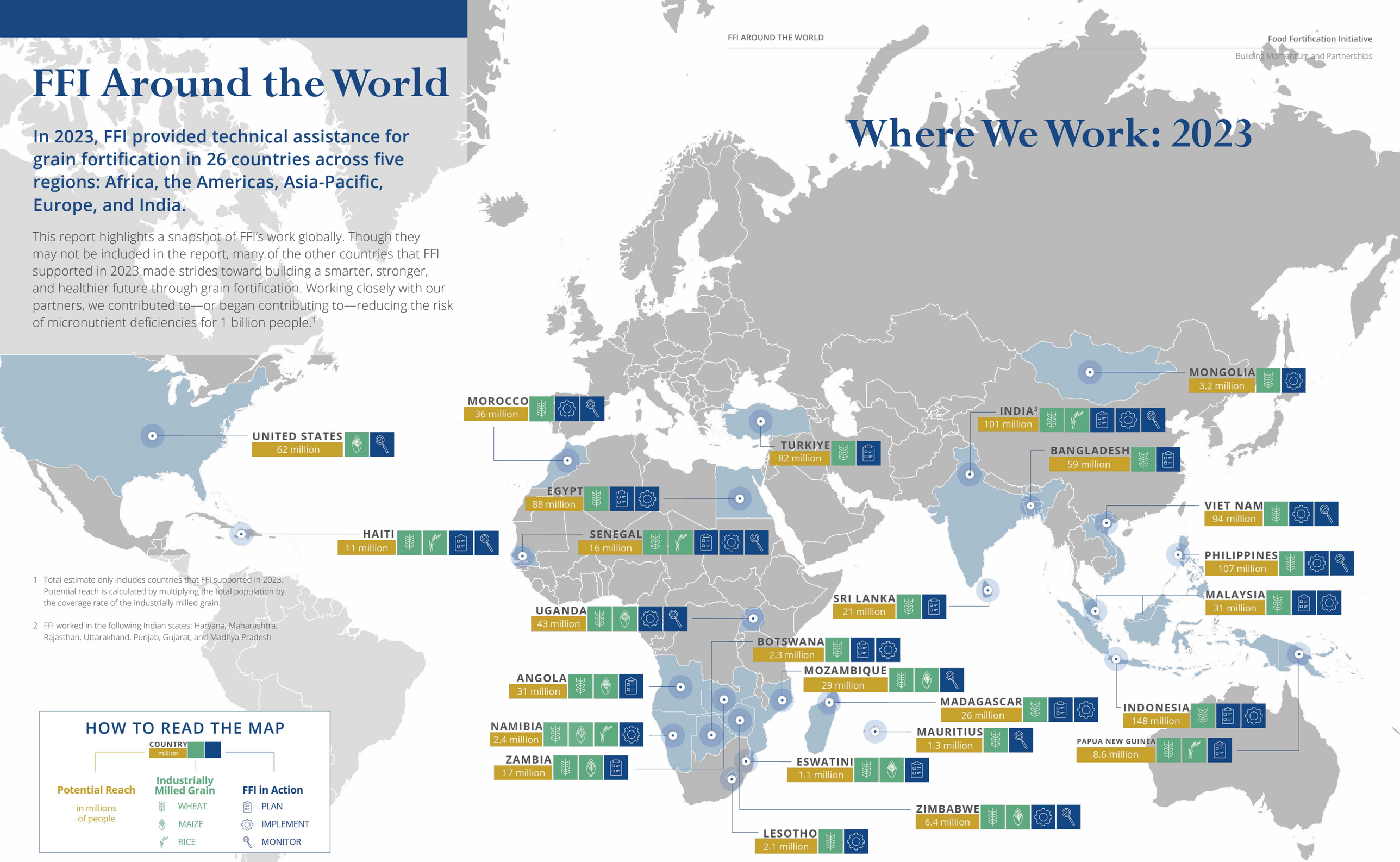
Scott Montgomery
Director, Food Fortification Initiative

FFI Around the World

In 2023, FFI provided technical assistance for grain fortification in 26 countries across five regions: Africa, the Americas, Asia-Pacific, Europe, and India.

This report highlights a snapshot of FFI's work globally. Though they may not be included in the report, many of the other countries that FFI supported in 2023 made strides toward building a smarter, stronger, and healthier future through grain fortification. Working closely with our partners, we contributed to—or began contributing to—reducing the risk of micronutrient deficiencies for 1 billion people.[1]

Where We Work: 2023



1 Total estimate only includes countries that FFI supported in 2023. Potential reach is calculated by multiplying the total population by the coverage rate of the industrially milled grain.

2 FFI worked in the following Indian states: Haryana, Maharashtra, Rajasthan, Uttarakhand, Punjab, Gujarat, and Madhya Pradesh

HOW TO READ THE MAP

COUNTRY
million

Potential Reach
in millions of people

Industrially Milled Grain
- WHEAT
- MAIZE
- RICE

FFI in Action
- PLAN
- IMPLEMENT
- MONITOR

FFI Staff Share Evidence Supporting Fortification at Two Global Conferences

Micronutrient Forum 6th Global Conference

Several FFI staff attended the Micronutrient Forum 6th Global Conference, October 16-20, 2023, in The Hague, The Netherlands, to share about FFI's work through sponsored symposiums, a booth, and poster presentations.

FFI hosted the symposium "Transforming Lives Through Wheat Flour Fortification in India" with the support of the Bill and Melinda Gates Foundation. The symposium highlighted the Indian state of Haryana, its journey to fortify wheat flour distributed in two districts through the Public Distribution System, a social protection program that reaches more than 3.3 million people in the districts, and the health impact of the fortification program.

Speakers included Scott Mongomery, FFI Director; Parveen Bhalla, FFI India Project Lead; Venkat Subramanian, former FFI India Technical Lead; Sonia Trikha, former Government of Haryana Director General of Health Services; and Mona Duggal and Reena Das, health impact study leads from the Postgraduate Institute of Medical Education and Research.

FFI staff were also invited to speak at a sponsored symposium on rice fortification in India and a symposium on the World Health Assembly's 2023 resolution on food fortification.

FFI hosted a virtual and in-person booth with the Iodine Global Network. Lastly, FFI staff hosted a learning center on the Global Fortification Data Exchange and presented several posters on fortification and its health impact in Haryana state as well as other FFI projects. Poster topics included the following:

- A global update on the status of prevention of folic acid-preventable spina bifida and anencephaly in 2020
- Countries' fortification standards vary in alignment with their respective regional standards: comparison of member country food fortification standards with EAC and SADC regional standards
- Experiences and lessons learned in establishing a new model for large-scale wheat flour fortification through social safety net programs in Haryana, India
- Monitoring Compliance of Fortified Wheat Flour to National Standards in Haryana, India
- National mandatory grain fortification legislation decreases anemia prevalence among nonpregnant women of reproductive age: findings from multiple demographic and health surveys
- The global status of food fortification

COP28: United Nations Climate Change Conference

At the 2023 United Nations Climate Change Conference (COP28), FFI Communications Director Jessie Genoway spoke at "Tackling Micronutrient Malnutrition in a Warming World," an event on December 10, 2023, in the Health Pavilion Blue Zone. Genoway discussed the interwoven relationship between climate change and micronutrient malnutrition and how interventions like large-scale food fortification can transform lives by building nutrition—and climate—resilience.

Held in honor of the conference's first time to dedicate a day to nutrition and climate change, the event highlighted the importance of optimizing population health and resilience amidst current and future challenges, particularly related to climate change.

In addition to Genoway, speakers from the Global Alliance for Improved Nutrition, International Federation for Spina Bifida and Hydrocephalus, Micronutrient Forum, Scaling Up Nutrition, Standing Together for Nutrition, and the World Health Organization proposed policy and action recommendations to enhance nutrition resilience while maintaining a neutral or positive impact on the environment. Key topics included nutrition-resilient systems, the resolution on food fortification adopted at the 2023 World Health Assembly, and Member States' efforts in using fortification to achieve nutrition resilience amidst climate change.

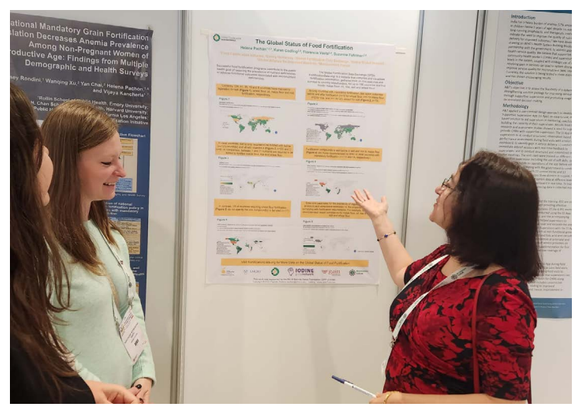


Photo: Events at the Micronutrient Forum 6th Global Conference, from top left to right: FFI symposium "Transforming Lives Through Wheat Flour Fortification in India", FFI staff and EMT celebrate at dinner in The Hague, FFI's booth, and Helena presents a poster. (FFI)

USAID AFFORD

Advancing food fortification globally

During the first year of the USAID Advancing Food Fortification Opportunities to Reinforce Diets (USAID AFFORD) project in 2023, FFI led a wide range of communications, knowledge management, research, and technical assistance activities to support large-scale food fortification in Madagascar, Senegal, and globally.

USAID AFFORD is a pioneering initiative dedicated to combating global micronutrient deficiencies, with a particular focus on groups vulnerable to poor nutrition, such as women of reproductive age and young children. Through the large-scale fortification of staple foods and condiments, USAID AFFORD aims to enhance nutrition outcomes on a global scale.

TechnoServe is implementing the five-year project in partnership with FFI, Nutrition International, and ISF Advisors. USAID AFFORD takes a comprehensive approach to advancing large-scale food fortification, engaging public, private, and civil society stakeholders. By uniting diverse expertise and resources, USAID AFFORD strives to create sustainable solutions for better nutrition and improved health outcomes worldwide.

Key milestones that FFI staff achieved through USAID AFFORD:

Developed a rapid zinc spot test and protocol in partnership with Brigham Young University This test addresses a critical regulatory monitoring gap and will help food producers and regulators quickly identify zinc that is added to fortified foods.

Provided technical assistance and support for the systematic review of economic outcomes associated with large-scale food fortification to strengthen evidence-based advocacy efforts

Facilitated desk reviews, partner assessments, and market assessments in target countries such as Senegal to evaluate large-scale food fortification landscapes and inform strategic plans

Made progress towards building a knowledge library for large-scale food fortification resources

Created a comprehensive knowledge management plan and a communications plan to build awareness of USAID AFFORD activities, share project learnings, and engage the large-scale food fortification community

Provided country-tailored research and technical assistance to Madagascar and Senegal after USAID AFFORD garnered buy-ins from the countries

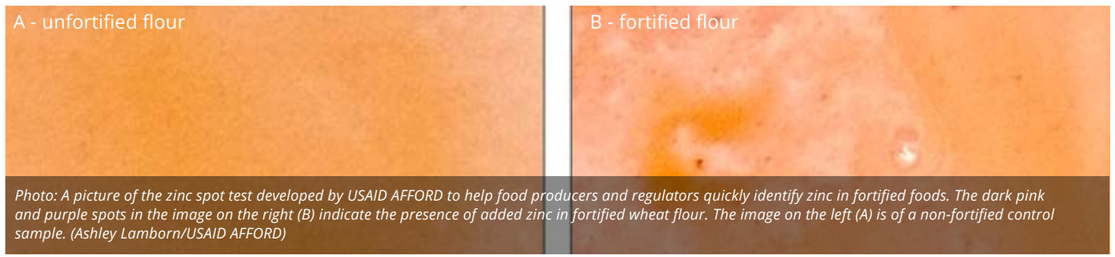


Photo: A picture of the zinc spot test developed by USAID AFFORD to help food producers and regulators quickly identify zinc in fortified foods. The dark pink and purple spots in the image on the right (B) indicate the presence of added zinc in fortified wheat flour. The image on the left (A) is of a non-fortified control sample. (Ashley Lamborn/USAID AFFORD)

Photo: Women in Madagascar. (Sarah Farhat/World Bank)

Building the Evidence Base for Fortification

FFI and partners are working to fill food fortification data gaps

and make already-available large-scale food fortification data accessible and actionable for decision-makers worldwide through two grants to FFI and its partners by the Bill & Melinda Gates Foundation in 2023.

One grant of $300,000 supports FFI for one year to conduct a literature review of evidence on the impact of large-scale food fortification for 10 commonly fortified staple foods: bouillon, fish sauce, maize flour, milk, oil, rice, salt, soy sauce, sugar, and wheat flour. The comprehensive literature review is gathering available evidence for the impact of food fortification on nutrient intake, nutritional status, and functional outcomes like reductions in the number of babies born with a neural tube defect (such as spina bifida and anencephaly).

"We hope this project will help inform the fortification policies and practices in countries that are planning or reviewing their existing large-scale food fortification programs," says Helena Pachón, PhD, principal investigator of the project and FFI research director.

Using this evidence, decision-makers can create effective fortification programs that ultimately reduce micronutrient deficiencies and improve lives.

A second grant of $1.5 million has been awarded to a consortium of partners led by the Micronutrient Data Innovation Alliance (DInA) to strengthen the Global Fortification Data Exchange (GFDx). Consortium members include the Micronutrient Forum, FFI at the Rollins School of Public Health, the Global Alliance for Improved Nutrition, and the Iodine Global Network. GFDx, a web-based analysis and visualization tool on food fortification launched in September 2017, is the most comprehensive database of large-scale food fortification information, providing national-level data for 196 countries. Widely used by global food fortification actors, it has been extensively cited in influential reports and journal articles, including the Global Nutrition Report, the 2023 World Health Assembly Resolution on food fortification, the 2022 WHO guidelines on wheat flour fortification, and the Food Systems Dashboard.

Megan Bourassa, DInA program lead, emphasized the pivotal role of partnership in developing the GFDx. She stated, "The partnership between organizations has been key to the success of the GFDx. We look forward to continued collaboration and filling important data gaps along the large-scale food fortification decision-making pathway."

The two-year grant will facilitate the expansion of the GFDx database, empowering national actors with the necessary data and insights to make informed decisions regarding food fortification initiatives.

Both grants are rooted in a strong network of partners with extensive experience working with and collecting food fortification data. By strengthening the evidence base for food fortification, the Bill & Melinda Gates Foundation, FFI, Micronutrient Forum, Global Alliance for Improved Nutrition, and Iodine Global Network demonstrate their commitment

2023 FFI Publications

Articles and stories published in 2023 by FFI staff that build the evidence base for food fortification

Ghotme, Kemel A., Arynchyna-Smith, Anastasia, Maleknia, Pedram, Kancherla, Vijaya, **Pachón, Helena**, Van der Wees, Philip J., Bocchino, & Joseph M., Rosseau, Gail L. (May 20, 2023). Barriers and facilitators to the implementation of mandatory folate fortification as an evidence-based policy to prevent neural tube defects. *Child's Nervous System*. 39, 1805-1812.

Loechl, Cornelia U., Datta-Mitra, Ananya, Fenlason, Lindy, Green, Ralph, Hackl, Laura, Itzkowitz, Laura, Koso-Thomas, Marion, Moorthy, Denish, Owino, Victor O., **Pachón, Helena**, Stoffel, Nicole, Zimmerman, Michael B., & Raiten, Daniel J. (September 14, 2023). Approaches to Address the Anemia Challenge. *The Journal of Nutrition*, 153 Suppl 1(Suppl 1), S42–S59.

Tewes-Gradl, Christina, Gilbert, Richard, Nelson, Jane, Schulte-Vennbur, Leo, **Montgomery, Scott, Genoway, Jessie, Enzama, Wilson, & Afrida, Ronald**. (September 26, 2023). Partnership Profile: Smarter Futures. In: *Fortifying Food Markets - Unlocking the potential of food fortification partnerships to improve nutrition*. Endeva and Corporate Responsibility Initiative at Harvard Kennedy School.

Photo: A group of women cleaning wheat grains. (Asian Development Bank)

REGIONAL HIGHLIGHTS

MAURITIUS

1.3 million potential reach

Mauritius mandates wheat flour fortification to combat micronutrient deficiencies

Recognizing the high prevalence of micronutrient deficiencies, particularly iron deficiency anemia, Mauritius embarked on a journey to fortify wheat flour in 2018. In 2023, Mauritius passed mandatory legislation for the fortification of wheat flour, a testament to the collaborative efforts of the Government of Mauritius, FFI, the Food and Agriculture Organization of the United Nations (FAO), and the Southern African Development Community (SADC).

FFI, alongside FAO and SADC, provided Mauritius with crucial technical assistance to establish a robust fortification program. Key accomplishments included the completion of a landscape analysis to assess the feasibility of wheat flour fortification, a cost-benefit analysis demonstrating the program's economic viability, a costed implementation plan for fortification, revision of food safety regulations to accommodate fortification, development of a national standard for fortified wheat flour, and contribution to a comprehensive national fortification strategy (2023-2028) outlining implementation, financing, monitoring, and evaluation plans.

Photo: Woman at a market in Mauritius. (Nicola Rinaldi)

With these essential elements in place, Mauritius made significant progress in 2023. The wheat flour fortification standards were finalized and gazetted, and mandatory fortification regulations received approval from the World Trade Organization.

As Mauritius implements the legislation, FFI will continue to provide technical assistance to officially launch the fortification program, build industry capacity for quality assurance and control, equip government regulators to monitor compliance, and provide tools to raise public awareness about the benefits of fortified wheat flour.

The successful passage of mandatory wheat flour fortification legislation represents a major public health victory for Mauritius. By ensuring access to essential micronutrients through a widely consumed staple food, this program has the potential to significantly improve the health and well-being of the Mauritian population, particularly women and children. Expected benefits include a reduction in neural tube defects and anemia rates, leading to enhanced overall health, increased productivity, and decreased healthcare costs for the nation.

UNITED STATES

62 million potential reach

New study shows most corn masa products in the United States are not fortified with folic acid

A 2023 FFI analysis of the corn masa supply chain and market in the United States (US) found that less than 6% of corn masa products in the United States are fortified with folic acid. Though many staple foods in the US are required to be fortified with folic acid, corn masa products—a key staple of the American Hispanic community—are not.

Hispanic women are 19% more likely than non-Hispanic women to have a pregnancy affected by a serious birth defect of the brain and spine called a neural tube defect. Lack of access to fortified foods contributes to Hispanic communities in the US experiencing these disproportionately high rates of neural tube defects like spina bifida.

The analysis was carried out with support from the US Centers for Disease Control and Prevention (CDC) as part of a larger CDC-FFI project to make evidence-based recommendations for scaling up corn masa fortification so that all American women get the essential micronutrients they need for a healthy pregnancy.

FFI Technical Advisor Sharon Bustrak, FFI's lead for the project, comments, "Through this research, we hope to better understand the gaps and opportunities for corn masa fortification in the US. These findings show that the US Food and Drug Administration's 2016 allowance for corn masa flour to be fortified by the food industry on a voluntary basis is not enough."

A CDC study estimated that 127 neural tube defects could be prevented annually by increasing folate status among Hispanic women whose sole folic acid source is through fortification.

"Our ultimate goal is for a more equitable American food system, where all corn masa flour manufactured in the US, along with all end-use products that are corn masa flour based, are fortified with folic acid to reduce the number of neural tube defects in the Hispanic population," Bustrak says.

Fortifying corn masa products in the US with folic acid provides a tremendous opportunity to transform lives, prevent birth defects, and reduce inequities in the American food system.

> **"Our ultimate goal is for a more equitable American food system, where all corn masa flour manufactured in the US...is fortified with folic acid to reduce the number of neural tube defects in the Hispanic population."**
>
> **- Sharon Bustrak, FFI Technical Advisor**

PACIFIC ISLANDS

9.5 million potential reach

FFI highlights opportunity to fortify the Pacific Islands

The Pacific Island region grapples with high rates of micronutrient deficiencies, contributing to health issues, especially among children and women. Anemia, vitamin A deficiency, and iodine deficiency are prevalent in the Pacific Islands and can negatively affect maternal and child health. The World Health Organization estimates that anemia prevalence in the region ranges from 27-49% among children aged 6-59 months and 26-37% among women aged 15-49 years.

To respond to the region's pressing nutritional needs, FFI created a proposal in 2023 to support 21 Pacific Island countries using a market-led, regional approach. The project will provide technical assistance to public, private, and civic sector partners in each of these island nations to ensure that high-quality fortified salt, wheat flour, and/or rice is widely available. For just over $6.8 million over five years, the project can reach vulnerable populations in the region, averting up to 189,277 cases of anemia among women of reproductive age and 440 cases of birth defects of the brain and spine.

The Pacific Island region relies on staple foods imported from a few key countries. To make food fortification more feasible for these food producers to implement and governments to regulate, FFI proposes to leverage the region's collective power and work with countries to set harmonized, mandatory legislation and standards for fortification.

For nations lacking established fortification policies, FFI's proposed activities include in-depth supply chain analyses and the development of customized plans covering the entire spectrum from drafting and approving standards to implementation and monitoring procedures. For countries with existing fortification programs, FFI will provide support as needed, which may include increasing the number of staple foods that are fortified, offering technical assistance to harmonize national and regional standards, improving industry compliance, or strengthening government regulatory practices.

The adoption of food fortification will not only help countries in the region achieve the United Nations Sustainable Development Goals but will also build a more resilient food system. Climate change is a clear threat to the region, making it more vulnerable to natural disasters and the food insecurity associated with these shocks. Climate change also diminishes the nutritional value of staple foods. Amidst these threats, food fortification emerges as a sustainable solution to build food security and strengthen the region's nutrition resilience.

Photo: Asian Development Bank

TÜRKIYE

82 million potential reach

Advocacy advances the conversation to fortify wheat flour in Türkiye

FFI staff officially restarted its efforts to explore and advance wheat flour fortification opportunities in Türkiye with a trip to Istanbul and Ankara in September 2023. As part of the trip, FFI met with public, private, and civic partners from the Turkish Ministry of Agriculture, the International Association of Operative Millers (IAOM) Eurasia Chapter, the Turkish Spina Bifida Association (TSBA), and UNICEF.

While in Ankara, FFI and the president of TSBA met with the head of the Department of Food Establishments and Codex at the Türkiye Ministry of Agriculture. They discussed the need and opportunity for mandatory wheat flour fortification, emphasizing the importance of preventing birth defects of the brain and spine through such interventions, and addressed the government's questions. FFI committed to conducting further research and completing a cost-benefit analysis to help the government weigh the financial cost and the sizable benefit of fortification.

Photo: Simit, a type of bread made with wheat flour, in Istanbul, Türkiye. (Jessie Genoway/FFI)

FFI met with UNICEF Turkey's Early Childhood Development team and the nutrition specialist at the UNICEF Europe and Central Asia Regional Office. Both expressed interest in engaging with FFI and other partners to help build a national wheat flour fortification. UNICEF's Europe and Central Asia Regional Office also offered to connect FFI with other country offices in the region that might need technical assistance on food fortification.

The trip concluded with FFI's participation in the IAOM Eurasia Conference in Istanbul. On the conference's main stage, Jessie Genoway, FFI Communications Director, presented the opportunity for wheat flour fortification in Turkey along with former TSBA and International Federation for Spina Bifida and Hydrocephalus Board Member Papatya Alkan Genca, who presented her lived experience of spina bifida in Türkiye. IAOM Eurasia sponsored a booth for FFI, where representatives from FFI, the International Federation for Spina Bifida and Hydrocephalus, and the Global Alliance for Prevention of Spina Bifida, shared communication materials and met with IAOM members from the region, including millers from Ukraine, Uzbekistan, and Türkiye.

The trip to Türkiye marked a significant step forward in FFI's mission to advance wheat flour fortification. Through strategic meetings and engagements, FFI was able to build a network of public, private, and civic sector champions for fortification, share knowledge, and lay the groundwork for a healthy, fortified future in the country.

INDIA 101 million potential reach

New project analyzes supply chain in two Indian states and builds the foundation for a fortification program

In April 2023, FFI started a new project with the Rockefeller Foundation to enable the scale-up of the fortification of whole wheat flour, also known as atta, with folic acid, iron, vitamin B12, and other micronutrients to prevent micronutrient deficiencies and help build a healthier future for the Indian states of Haryana, Maharashtra, and Rajasthan.

Wheat flour is a widely consumed staple food in these states. The project aims to deliver fortified flour to those who need it most—low-income women and children who often do not have access to a diverse diet—via state-led social protection programs: the Public Distribution System (PDS) via the Food and Civil Supplies Department (F&CS), the mid-day meal program known as PM POSHAN, and the Integrated Child Development Services (ICDS).

The primary activities undertaken in the grant are centered around (1) providing technical assistance on implementing wheat flour fortification to the government agencies, millers, and fair price shops involved in the last-mile delivery of food for the PDS and (2) demonstrating the benefits of fortified wheat flour to government agencies for its inclusion into PDS, PM POSHAN, and ICDS, and securing buy-in from government stakeholders for its inclusion in PDS, PM POSHAN, and ICDS programs.

To begin planning for the fortification programs, FFI completed wheat flour supply chain analyses for Maharashtra and Rajasthan. The supply chain analyses describe feasible channels for atta fortification, best practices for ensuring the program's sustainability, and the estimated cost of fortification for beneficiaries. FFI presented the analyses to key state social protection program officials in a series of meetings and at a workshop in Rajasthan in December 2023.

At the workshop, FFI also oriented Rajasthan state officials on key wheat fortification information, including the burden of micronutrient deficiencies in the state, their impact on health for vulnerable groups, and the role of fortification in helping the state reach economic and welfare goals. The presentation also included current scientific literature on fortification as a strategy to eliminate micronutrient deficiencies, which is particularly relevant to India and the specific state. The

Photo: FFI workshop in Rajasthan in December 2023. (FFI)

> **I have seen changes occurring in cereals and maintaining the micronutrient [content] is quite challenging. Fortification can help in many ways.**
>
> **- Ashish Vyas, Rajasthan PM POSHAN Deputy Commissioner**

December workshop provided the latest updates in the state's work to start wheat flour fortification and complemented two previous workshops that FFI hosted in Jaipur in early 2023.

One attendee, Ashish Vyas, deputy commissioner of Rajasthan PM POSHAN, said, "I have seen changes occurring in cereals and maintaining the micronutrient [content] is quite challenging. Fortification can help in many ways." He commented that he saw fortification as an effective strategy to ensure beneficiaries receive the essential nutrients they need.

Thirty-six participants attended, including representatives of four key state departments (ICDS, PM POSHAN, Confed, and the Food Safety and Drug Control Commissionerate) as well as partners from Fortify Health and World Food Programme India Office, which is supporting the provision of fortified atta through the state PM POSHAN scheme.

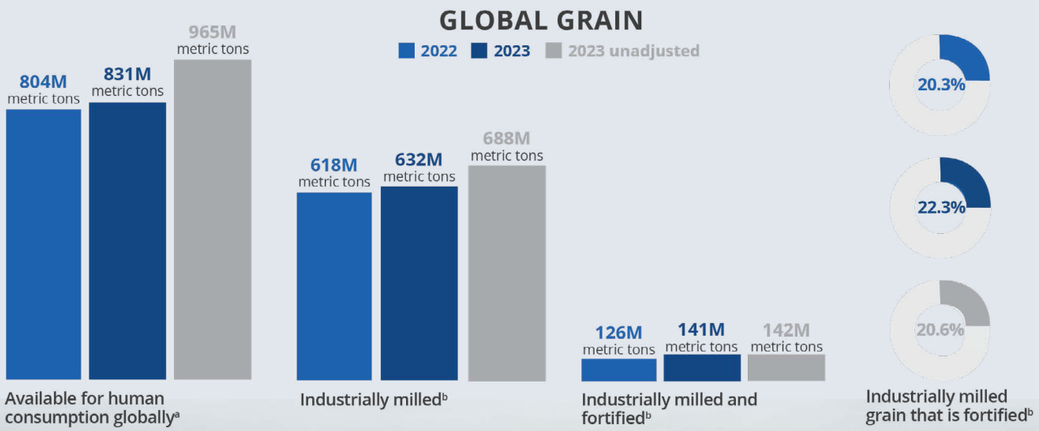
In closing remarks at the workshop, Manju Yadav, a deputy director for Rajasthan ICDS, said, "Fortification is not new for us. We are aware of every aspect and benefit of fortifying cereals, and we've been in regular connection with the FFI team. Hopefully, we can come together to ensure the maximum benefits to the beneficiaries through food fortification."

FFI and the Rockefeller Foundation's support to better understand the wheat flour supply chain and fortification opportunities in Rajasthan and Maharashtra lays the groundwork for private, public, and civic partners to work together and build fortification programs that transform lives.

Wheat Maize Rice

The total amount of grain available for human consumption, amount of fortified grains, and percentage of industrially milled grain that is fortified all increased from 2022 to 2023, representing positive upward trends in global fortification.

The percentage of industrially milled grain that is fortified rose from 19.5% to 20.6%. While the volume of fortified maize and wheat decreased, global production increased for wheat, and the amount of industrially milled grain increased for both wheat and maize. Rice saw the largest increase in the amount of grain available for human consumption, as well as a 4% increase in the percentage of industrially milled grain that is fortified. These increases reinforce the need for further growth in the creation and sustenance of large-scale grain fortification.



a FAO data with additional, openly available data sources. 2022 estimates: 2020 FAOSTAT, Supply Utilization Accounts, Food (element 5141) 2020 Data: https://www.fao.org/faostat/en/#data/SCL
2023 estimates: 2021 FAOSTAT, Supply Utilization Accounts, Food (element 5141) 2021 Data: https://www.fao.org/faostat/en/#data/SCL

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Photo: Xaume Olleros/RTI

When only considering countries where FFI determines there is an opportunity for fortification, there was also an increase in the amount of industrially milled grain that is fortified (from 20.3% to 22.3%). This can mainly be attributed to the 153% increase in fortified rice, which is an astounding positive change in rice fortification that demonstrates the efforts of fortification partners worldwide.

Globally, an increasing proportion of all three grains is processed in large-scale facilities, meaning a larger proportion of grain can be fortified. This represents a growth in fortification opportunity that governments and development partners can capitalize on through coordinated action and implementation of large-scale food fortification programs.

How we calculate global estimates

Measuring global progress in grain fortification through an annual survey.

Methodology

We measure global progress in grain fortification using multiple data sources. We begin with data from the Food and Agriculture Organization (FAO) of the UN that describes how much flour or milled rice is available in the food supply for each country.

FFI applies specific criteria to data from each country that focuses our calculations on the grain(s) that would be good candidates and excludes the grain(s) that would not be good candidates for large-scale fortification. This primarily means emphasizing grains that are widely consumed and mostly industrially processed. The methods are described in "How we calculate global estimates – opportunity."

Flour and rice available

For countries with FAO data, we use the Supply Utilization Account (SUA) food supply quantity (tons) element to determine the amount of available wheat flour, maize flour, and milled rice. If a country or territory does not have FAO data available, we use publicly available data and, as needed, extraction rates to convert grain numbers to flour available. If country-specific extraction rates are available, those are applied. Otherwise, the default extraction rate for wheat in its conversion from grain to flour is 75%. The default extraction rate for maize varies by region, with 67.5% used for Africa, 72.5% for the Americas, and 70% elsewhere. We collect data on milled, hulled, and broken rice in our estimates. As a result, it is not necessary to apply a default extraction rate to rice.

Industrially milled & percentage fortified

We then determine the amount of flour or milled rice that is industrially produced. For countries in FFI's Europe region, we assume that 100% of the wheat flour, maize flour, and rice are industrially milled. Countries in FFI's Americas region are assumed to industrially process 100% of their wheat flour.

We also ask national partners in governments, milling associations, nongovernmental organizations, the private sector, and UN agencies worldwide to estimate how much of each grain is industrially processed and fortified in their country. We then compile the country figures into global estimates. It is important to note that, at times, FFI is not aware of changes to national milling infrastructure when they happen, which can cause a data lag. We provide the best estimate of global milling based on the information currently available to us.

Opportunity

Based on these findings and calculations, FFI determines if countries could be considered a good opportunity for large-scale grain fortification. For each grain, FFI examines the grams available per person per day. If a country has more than 25 grams of wheat or more than 37.5 grams of maize or rice available per person per day, it may be a good opportunity. However, another consideration is whether one grain is much more popular than another. For example, even though the average Jordanian eats more than 37.5 grams of rice per day, they eat more than 176 grams of wheat per day. As such, rice may not be considered a priority for fortification in Jordan. Lastly, FFI is primarily concerned with large-scale fortification, meaning that grain must be primarily produced at industrial mills to be considered a good opportunity for fortifying. These factors and others, such as urbanicity, are used to determine which grain(s) may be a good opportunity for fortification in each country.

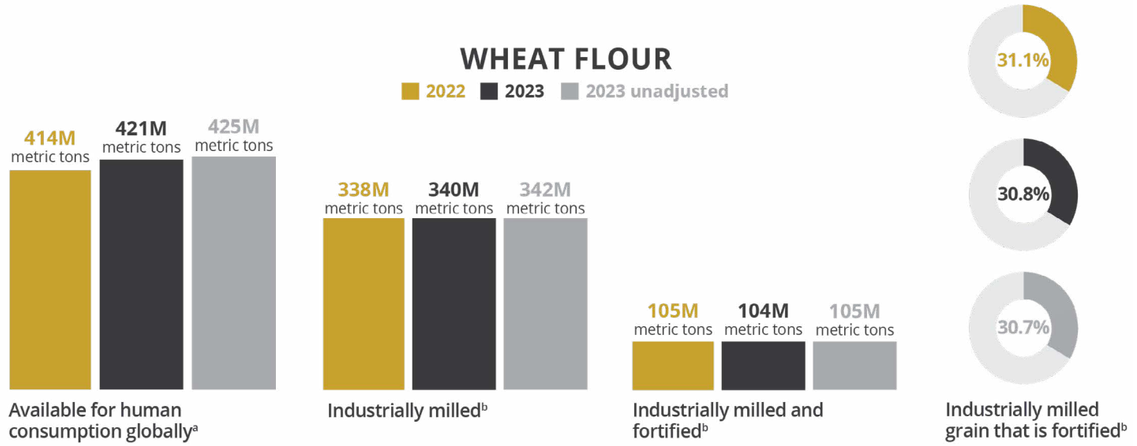
Photo: A. Krepkih/UNICEF Ukraine

Photo: A meal in Morocco. (Charlie Marchant)

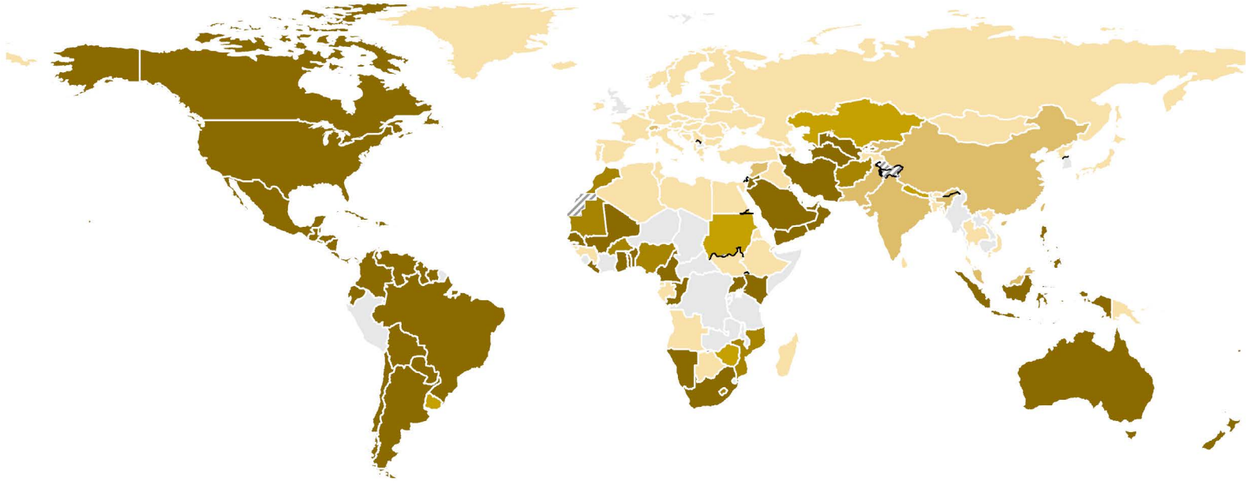
Wheat

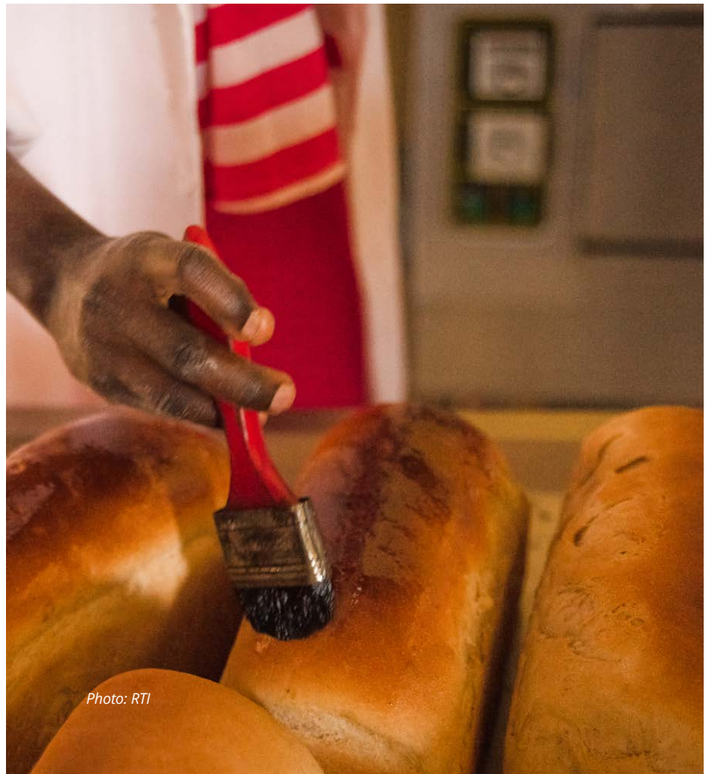
FFI's calculations show small increases from 2022 to 2023 in the amount of wheat flour globally available for human consumption (+1.9%) and industrially milled wheat flour available (+0.3%). However, there was a small decrease in industrially milled wheat flour that is fortified (-1.3%). Overall, the percentage of industrially milled wheat flour that is fortified decreased from 31.3% to 30.8%. When only considering countries FFI categorizes as good opportunities for fortification, the percentage of industrially milled wheat flour that is fortified also decreased from 31.1% to 30.9%.

Nevertheless, there was only a small decrease in the percent of industrially milled wheat flour that is fortified amid global conflicts such as the Russia-Ukraine War, attesting to the continued effort of countries and fortification partners to fortify wheat on a large scale. Continued vigilance and improvement in wheat fortification programs will not only strengthen existing fortification but ensure that fortification continues even amidst large disruptions in supply-chain pipelines.



Percentage of industrially milled wheat that is fortified, adjusted for opportunity - 2023





LEGEND

- 75-100%
- 50-74%
- 25-49%
- 1-24%
- 0-<1%
- Not an opportunity for wheat flour fortification

a FAO data with additional, openly available data sources.
2022 estimates: 2020 FAOSTAT, Supply Utilization Accounts, Food (element 5141) 2020 Data: https://www.fao.org/faostat/en/#data/SCL
2023 estimates: 2021 FAOSTAT, Supply Utilization Accounts, Food (element 5141) 2021 Data: https://www.fao.org/faostat/en/#data/SCL

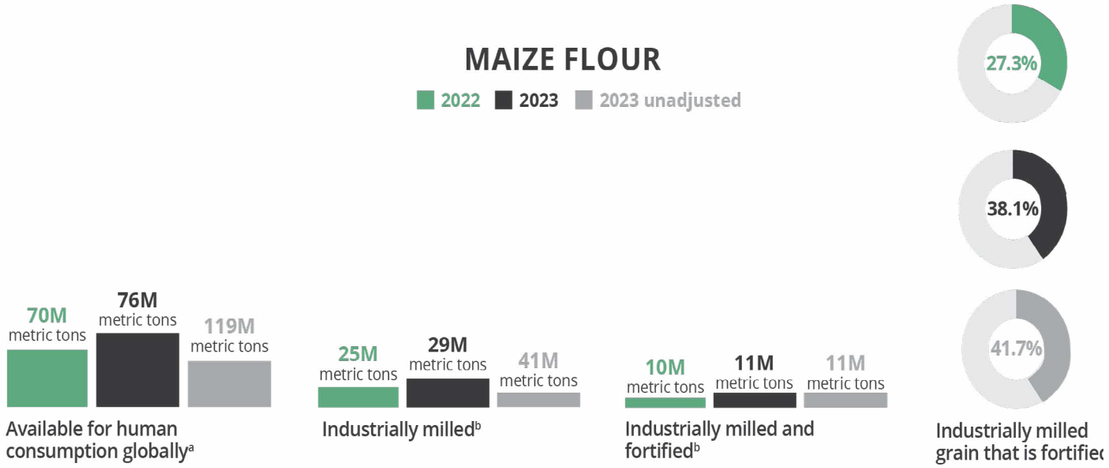
b FFI calculations.

Maize

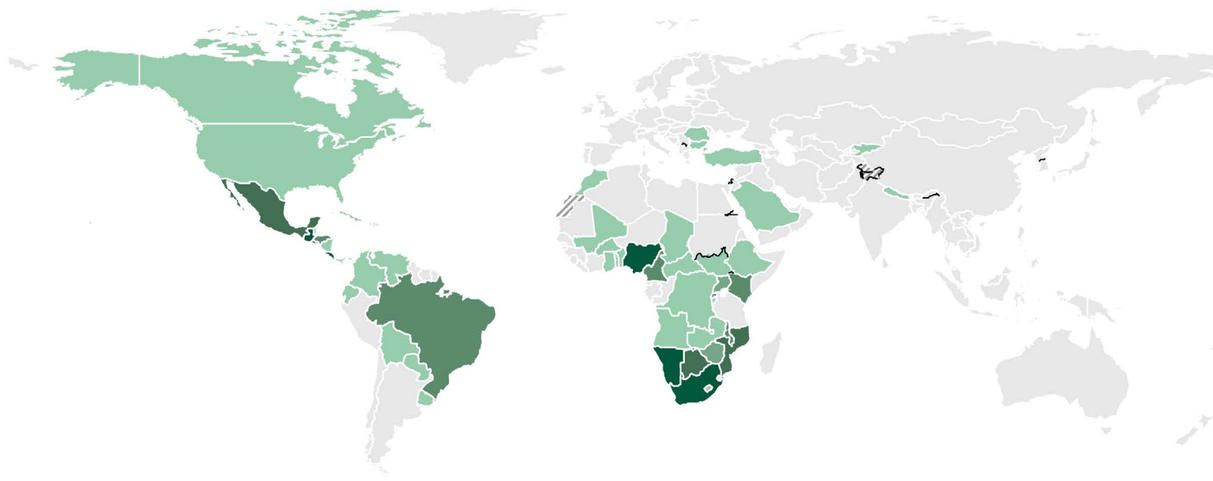
There were decreases from 2022 to 2023 in the amount of maize flour available for human consumption (-5.9%) and the amount of fortified maize flour (-6.3%). However, there was a large increase in the amount of industrially milled maize flour (+17%). Countries like Argentina and Brazil contributed the most to the increase in the amount of industrially milled maize flour. South Africa is one of a few countries that fortified maize flour in large amounts but saw a 51% decrease in fortified maize flour this year, which likely contributed significantly to the overall drop in the amount of fortified maize.

When looking specifically at countries FFI considers good opportunities for fortification, the percentage of industrially milled maize flour that is fortified also decreased slightly, from 41.7% to 36.2%. This change is not because the amount of fortified maize flour has decreased but because the amount of industrially milled maize flour has increased. This represents growth in the amount of maize that has the potential to be fortified.

Compared to wheat or rice, a larger proportion of maize flour is processed in non-industrial mills, making it difficult to fortify. However, maize is a staple food in many countries, representing a large opportunity for addressing micronutrient deficiencies and their consequences where it is fortifiable.



Percentage of industrially milled maize that is fortified, adjusted for opportunity - 2023



LEGEND

- 75-100%
- 50-74%
- 25-49%
- 1-24%
- 0-<1%
- Not an opportunity for maize flour fortification

a FAO data with additional, openly available data sources. 2022 estimates: 2020 FAOSTAT, Supply Utilization Accounts, Food (element 5141) 2020 Data: https://www.fao.org/faostat/en/#data/SCL 2023 estimates: 2021 FAOSTAT, Supply Utilization Accounts, Food (element 5141) 2021 Data: https://www.fao.org/faostat/en/#data/SCL

b FFI calculations.

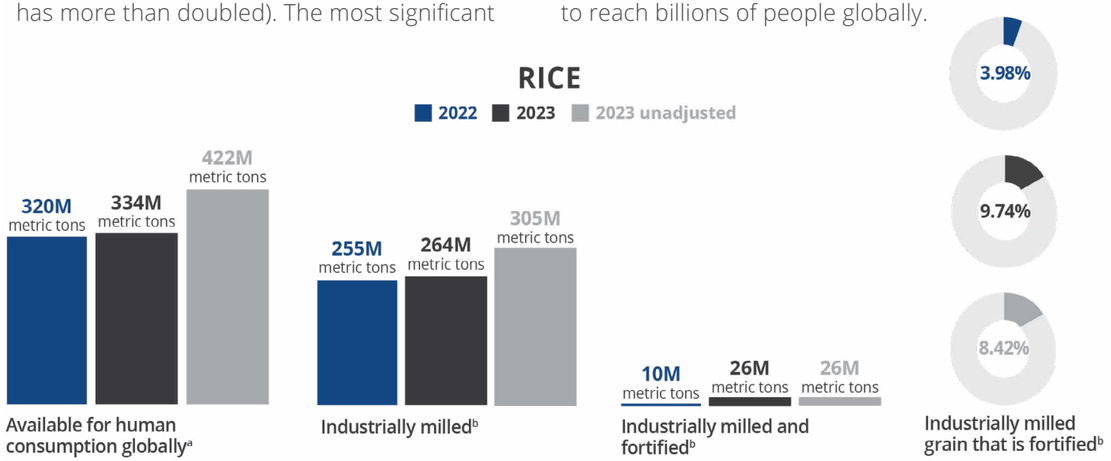
Photo: Tran Thi Hoa/World Bank

Rice

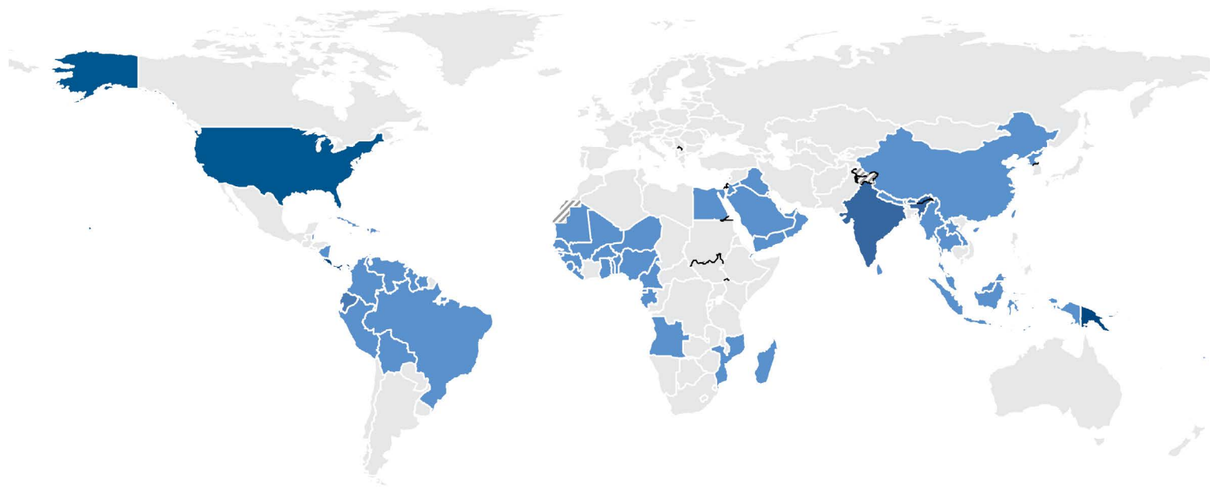
From 2022 to 2023, there was an increase in the volume of rice available for human consumption (+5.3%) and the amount of industrially milled rice (+4.9%), and a large increase in the amount of fortified rice (+113.1%). These trends are very promising since rice is widely consumed but has historically been fortified at low rates.

One large difference from 2022 to 2023 is that the percentage of industrially milled rice that is fortified in countries with fortification opportunities has increased from 3.98% to 9.74%. This is due to previously mentioned increases (notably, the amount of fortified rice has more than doubled). The most significant contributor to the increase of fortified rice is India, with an increase of 13 million tons of fortified rice. Cambodia, Myanmar, and Thailand had the largest increases in the amount of industrially milled rice.

These positive trends are encouraging and show the dedication and effort of global fortification partners in increasing rice fortification. However, given that less than 10% of the industrially milled rice in countries FFI considers good opportunities for fortification are being fortified, the potential to increase the fortification of rice is significant. This intervention has the potential to reach billions of people globally.



Percentage of industrially milled rice that is fortified, adjusted for opportunity - 2023



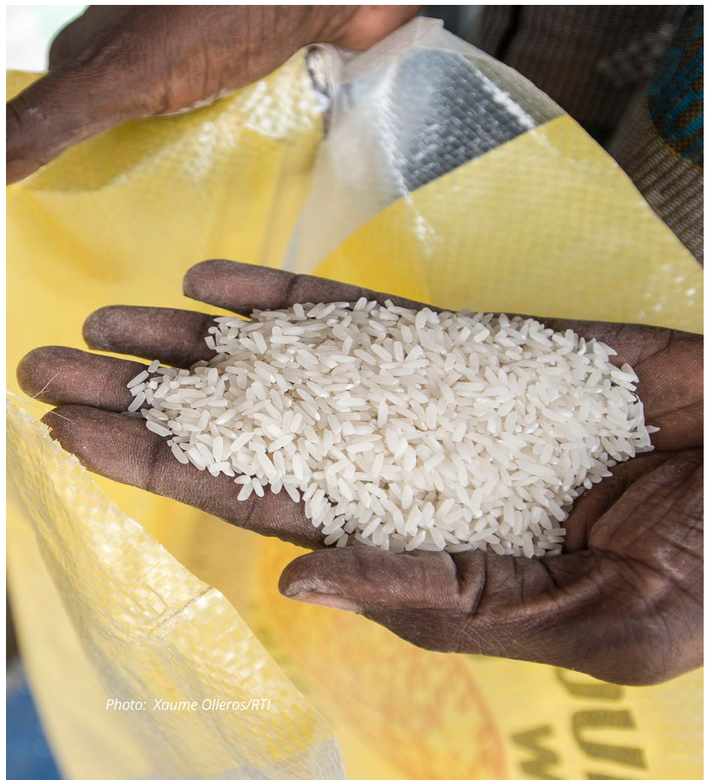


Photo: Xaume Olleros/RTI

LEGEND

- 75-100%
- 50-74%
- 25-49%
- 1-24%
- 0-<1%
- Not an opportunity for rice fortification

a FAO data with additional, openly available data sources.
2022 estimates: 2020 FAOSTAT, Supply Utilization Accounts, Food (element 5141) 2020 Data: https://www.fao.org/faostat/en/#data/SCL
2023 estimates: 2021 FAOSTAT, Supply Utilization Accounts, Food (element 5141) 2021 Data: https://www.fao.org/faostat/en/#data/SCL

b FFI calculations.

Photo: Travelwayoflife/Flickr

Legislation Update

In 2023, mandatory legislation was created in Sri Lanka and Mauritius to fortify wheat flour. Wheat flour fortified with essential micronutrients will reach approximately 1.3 million people in Mauritius and 21 million in Sri Lanka.

Globally, 94 countries have legislation to mandate fortification of at least one industrially milled cereal grain. Of these, 93 countries mandate the fortification of wheat flour alone or in combination with other grains. One country—Papua New Guinea—has a mandate only for rice fortification.

When FFI was founded in 2002, only 38 countries mandated fortification of wheat flour, maize flour, or rice.

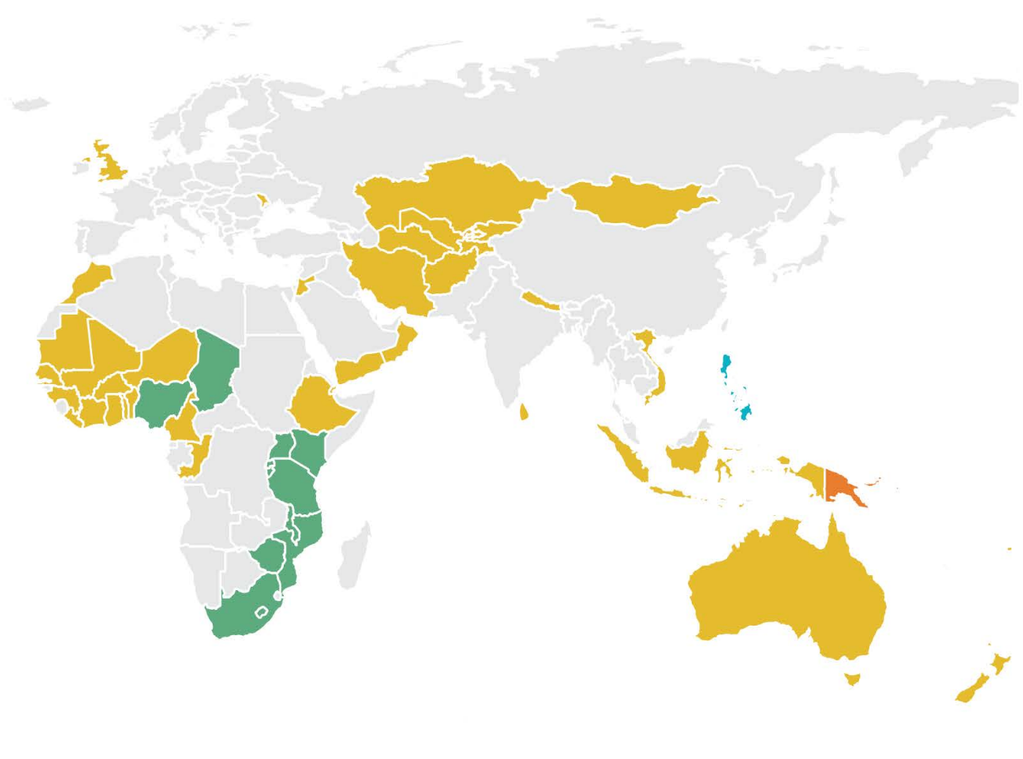
Mandatory Cereal Grain Fortification Legislation, 2023

LEGEND

- Wheat flour alone – 69 countries
- Rice alone – 1 country (Papua New Guinea)
- Wheat flour and maize flour – 17 countries
- Wheat flour and rice – 5 countries (Nicaragua, Panama, Peru, Philippines, Solomon Islands)
- Wheat flour, maize flour, and rice – 2 countries (Costa Rica and the United States)
- No mandatory fortification legislation or data not available

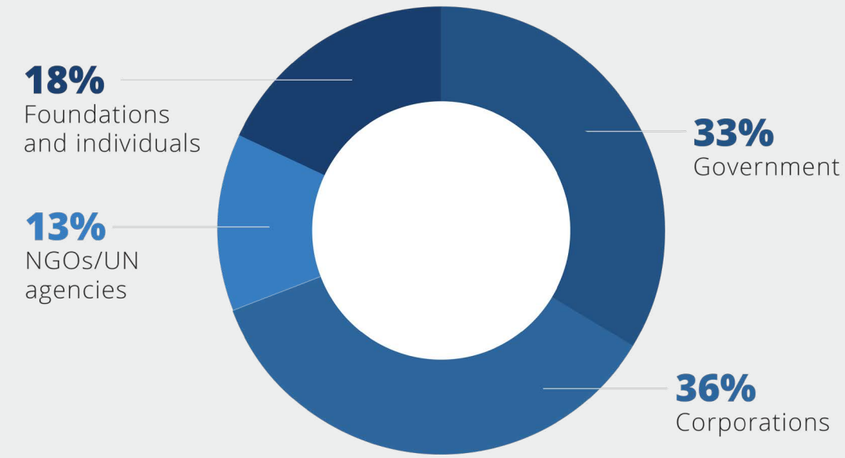
Legislation has effect of mandating grain fortification with at least iron or folic acid.

Legislation status from the Food Fortification Initiative (www.FFInetwork.org) November 2023.



Gift Profile

We are grateful to the individuals and donors who support our work. Contributions for 2023 were US $1 million.



How to contribute

Your gift will make a difference by reducing the debilitating effects of anemia, preventing thousands of serious birth defects a year, and strengthening immune systems to prevent premature death in children and adults alike. Join us and donate to FFI.

Photo: Working a rice field. Xaume Olleros/RTI

Executive Management Team

An Executive Management Team (EMT) representing global leaders in the public, private, and civic sectors provides FFI's strategic direction.

Markus Lotsch, EMT Chair
President, Health and Wellness
Archer-Daniels-Midland Company

Troy Anderson
Vice President, Operations
Ardent Mills

Jeff Zyskowski
Vice President, Supply Chain
Ardent Mills

Jane Friedrich (former member as of May 2024)
Vice President, Global Core R&D
Cargill, Inc.

Reynaldo Martorell
Woodruff Professor of International Nutrition
Senior Advisor, Global Health Institute
Emory University

Florencia Vasta (Penjani Mkambula in 2023)
Program Lead, Large Scale Food Fortification
Global Alliance for Improved Nutrition

Melinda Farris
CEO
International Association of Operative Millers

Sylvia Roozen
Secretary General
International Federation for Spina Bifida and Hydrocephalus

Homero Martinez
Senior Technical Advisor
Nutrition International

Manpreet Chadha (Vilma Tyler in 2023)
Nutrition Specialist - Food Systems for Children
United Nations Children's Fund (UNICEF)

In addition to the eight EMT members, leaders from the CDC and WHO are EMT observers, including:

Jenny Williams
Team Lead, Neural Tube Defects Surveillance and Prevention Team, Division of Reproductive Health - National Center on Birth Defects and Developmental Disabilities
Centers for Disease Control and Prevention

Ruth Petersen
Director, Division of Nutrition, Physical Activity, and Obesity - National Center for Chronic Disease Prevention and Health Promotion
Centers for Disease Control and Prevention

Juliawati Untoro (Luz María De-Regil in 2023)
Scientist, Multisectoral Action in Food Systems
World Health Organization

Photo: Woman rolling bread dough in Türkiye. (Adam Cohn)

Photo: Wheat in a field. (Hannes Flo)

Staff and EMT Updates

In 2023, FFI welcomed one new staff member to the team, Sharon Bustrak, and several new EMT members-- Troy Anderson, Jeff Zyskowski, and Homero Martinez.

Sharon Bustrak, Technical Advisor, FFI

Sharon joined FFI in June 2023 as a Technical Advisor with a focus on conducting research and data analysis concerning global nutrition, milling, and fortification. Sharon supports FFI's United States corn masa flour project and the planning, implementation, and monitoring of fortification programs in the Asia-Pacific, Latin American, and Central Asian regions. Before joining as a staff member, Sharon worked for FFI as a Graduate Research Assistant (May 2022-May 2023), where she conducted a desk review of global milling data and completed the 2022 survey of global cereal grain fortification.

Sharon holds a Master of Public Health in Epidemiology from Emory University and has experience living and working in the Middle East, Africa, and Asia in health education, clinical, and research settings.

Homero Martinez, Senior Technical Advisor, Nutrition International

Homero joined the FFI EMT in October 2023. As a Senior Technical Advisor for Nutrition International, Homero Martinez, MD, PhD, heads the secretariat for the Folate Task Team, a global group of multi-disciplinary, world-renowned experts working to support a global strategy for the control of folate insufficiency in women of reproductive age to reduce the risk of pregnancies affected by folate-sensitive neural tube defects. Homero is a medical doctor with a specialty in pediatrics and a doctoral degree in international nutrition, with more than 30 years of experience as a senior researcher in nutrition, public health, epidemiology, and health systems. He has published over 160 peer-reviewed articles and 54 book chapters and edited 14 books, with over 5,000 citations to his work.

Troy Anderson, Vice President, Operations, Ardent Mills

Troy Anderson and Jeff Zyskowski, representatives of Ardent Mills, joined FFI's EMT in May 2023.

Troy serves as Vice President of Operations at Ardent Mills in Denver, Colorado. Troy leads all aspects of plant operations for Ardent Mills across the US, Canada, and Puerto Rico by driving strong cross-functional collaboration while ensuring a common team member and customer experience, overseeing operational excellence and regulatory compliance, and serving as a talent leader for the operations function. Troy is from rural McPherson County and graduated from Kansas State University in May 1992 with a bachelor's degree in Milling Science and Management. Troy joined Cargill upon graduating and held various positions within Cargill's US flour milling and grain operations prior to his current role with Ardent Mills.

Jeff Zyskowski, Vice President, Supply Chain, Ardent Mills

Jeff is the Vice President of Supply Chain for Ardent Mills. In his role, Jeff is responsible for leading the supply chain, customer service, procurement, transportation, and logistics functions of the business. Jeff also helps shape the overall business strategy as part of the Ardent Mills senior leadership team and is the executive sponsor for environmental, social, and corporate governance (ESG) at Ardent Mills. Ardent Mills' operations and services are supported by more than 40 flour mills and bakery-mix facilities, as well as a specialty bakery, all located in the US, Canada, and Puerto Rico.

Before Ardent Mills, Jeff spent 24 years at Cargill and Horizon Milling with trading, supply chain, and commercial management positions, primarily in the flour-milling business. Jeff is a graduate of St. Olaf College in Northfield, Minnesota, with a degree in Math and Economics.

Photo: Abbas Farzami/Rumi Consultancy/WorldBank

FFI's Unique Contributions

to Global Grain Fortification

Expertise

FFI's in-house leadership and technical expertise enable us to apply a data-driven approach to program planning, implementation, and monitoring.

Rigor

FFI operates through a unique model, bringing together voices from the public, private, and civic sectors through our Executive Management Team and our technical assistance to make sustainable change.

FFI conducts supply chain analyses for any given grain to discover and act on opportunities to advance fortification.

FFI documents and publishes up to 196 countries' annual potential and progress toward successful cereal grain fortification.

Focus

FFI is the only global group that focuses exclusively on large-scale fortification of the three most consumed grains: wheat flour, maize flour, and rice.

Inspired by the Good to Great model by Jim Collins

How We Work

FFI's strategic approach to scaling grain fortification, based on two decades of experience conducting research and providing on-the-ground assistance, offers a replicable method to building and strengthening fortification programs.

FFI chooses countries, regions, states, and provinces through rigorous research. We take a holistic, objective approach with the goal to help eliminate micronutrient deficiencies in every country where industrially milled cereal grain is commonly consumed. FFI does not have a predetermined set of countries it will support; instead, it relies on data to identify where the needs and opportunities are greatest.

Photo: Neil Palmer/CIAT

Before FFI begins working in a country, we use data to determine two essential requirements: demonstrated need for fortification and the potential to make a positive impact on health through fortified food. Our data comes from several sources and through varied methods including consumption and milling analyses, nutrition needs assessments, market analyses, political readiness assessments, systematic reviews, and partner interviews. Once an opportunity for fortification is determined, FFI uses a four-stage phased approach to help countries plan, implement, and monitor a fortification program that can generate and sustain large-scale impact.

Plan

PHASE 1: EXPLORE AND ENGAGE

- Engage private sector
- Engage birth defects groups, neurosurgeons, and consumer associations
- Identify key challenges and opportunities
- Identify fortification champion(s) within the government
- Determine what it will take to move forward

MILESTONE

Once the government expresses permission and willingness to move forward, FFI will move to the next phase of planning: map the context.

PHASE 2: MAP THE CONTEXT

- Conduct a thorough supply chain analysis
- Assess industry structure, including readiness and reach of mills
- Assess monitoring structure and needs
- Map the legislative process
- Assess budgetary needs (initial investment by sector and annual recurring costs) to ensure commitment and sustainability
- If necessary, conduct a cost-benefit analysis making the case for fortification's impact on national health and economic indicators

MILESTONE

At this stage, FFI gives a formal presentation to government stakeholders to recommend effective staples and market channels based on diagnostic results. Once the government expresses permission and support for the plan, FFI will move to the next phase: implement - design and develop.

Implement

PHASE 3: DESIGN AND DEVELOP

- Draft recommended standards
- Identify miller, regulatory inspector, and laboratory training needs
- Support the premix procurement process
- Engage the legislative process
- Develop a communication and education strategy
- Integrate realistic fortification monitoring into an existing framework

MILESTONE

Clear budget and implementation plan.

- Train millers on quality assurance/quality control practices
- Train regulatory monitoring inspectors and lab staff; map agency responsibilities
- Facilitate the passage of legislation
- Develop a National Guideline for Fortification document and national logo, as necessary

MILESTONE

The fortification program is implemented and ready to scale.

Monitor

PHASE 4: MONITOR FOR COMPLIANCE AND IMPACT

- Support collection of monitoring data
- Ensure monitoring data is shared with relevant stakeholders
- Augment government monitoring partnerships with civic entities
- Ensure action is taken to improve program performance based on monitoring data

MILESTONE

Ensure program reaches intended population

- When applicable, partner with stakeholders to measure impact

Why Fortify?

Nutrition can be a matter of life and death. More than two billion people globally suffer from vitamin and mineral deficiencies.[1]

One in two preschool-aged children and two in three women of reproductive age worldwide suffer from at least one vitamin or mineral deficiency, increasing their vulnerability to infectious disease and compromising child growth and development.[1] Fortifying grains to prevent these micronutrient defeciencies can strengthen the health of individuals, populations, and countries' economies.

Micronutrient defeciencies affect an estimated:[1]

2B+ people worldwide

56% of preschool-aged children

69% of women of reproductive age

Photo: Xaume Olleros/RTI

Anemia is often caused by deficiencies of micronutrients including iron and zinc. Children, pregnant women, and women of reproductive age (15-49 years) who are unable to include enough micronutrients in their diet are at risk for anemia. Pregnant women with severe anemia are twice as likely to die during or shortly after pregnancy than non-anemic women.[2] Globally, nearly 250 million women of reproductive age are affected by iron deficiency anemia; if they stood head to toe, they could reach the moon and circle it.[3]

Iron deficiency in childhood stunts cognitive development, which hinders academic performance and future earnings potential as adults.[4]

Zinc deficiency adversely affects children and adults by weakening immune systems, increasing rates of childhood diarrhea and pneumonia, and contributing to increased rates of childhood stunting. Globally, zinc deficiency contributes to 116,000 child deaths per year—a number that would be much higher if researchers were able to count the number of deaths caused by preterm births in zinc-depleted mothers.[5]

Anencephaly and spina bifida are birth defects of the brain and spine that can be prevented by consuming enough folic acid, also known as vitamin B9. About 75% of children born with brain and spinal birth defects die before their fifth birthday.[6] Though spina bifida has varying degrees of severity, it often leads to life-long disability and enormous costs for healthcare systems. Anencephaly is always fatal.

Vitamin B12 benefits children, adults, and the elderly by maintaining functions of the brain and nervous system.[7] Consuming adequate amounts of vitamin B12 can reduce the risk of developing chronic diseases including heart disease, stroke, dementia, Alzheimer's disease, and Parkinson's disease.[7]

Fortification with micronutrients, including iron, zinc, folic acid, and other B vitamins, benefits individuals at every point in life—from conception to aging.

Photo: Thomas Cristofoletti/Ruom for RTI

A call to action

Research published using FFI data credited fortification with preventing 61,677 brain and spine birth defects globally in 2020 for an average of 169 healthier babies a day.[8] Yet according to estimates, an additional 78% of birth defects of the brain and spine[8] and 34% of anemia[9] could still be prevented globally through adequate intake of folic acid and iron, respectively. That's why FFI's mission to build high-impact, self-sustaining fortification programs is so important. **By improving nutrition, we can create a smarter, stronger, and healthier world.**

Photo: World Bank/Sarah Farhat

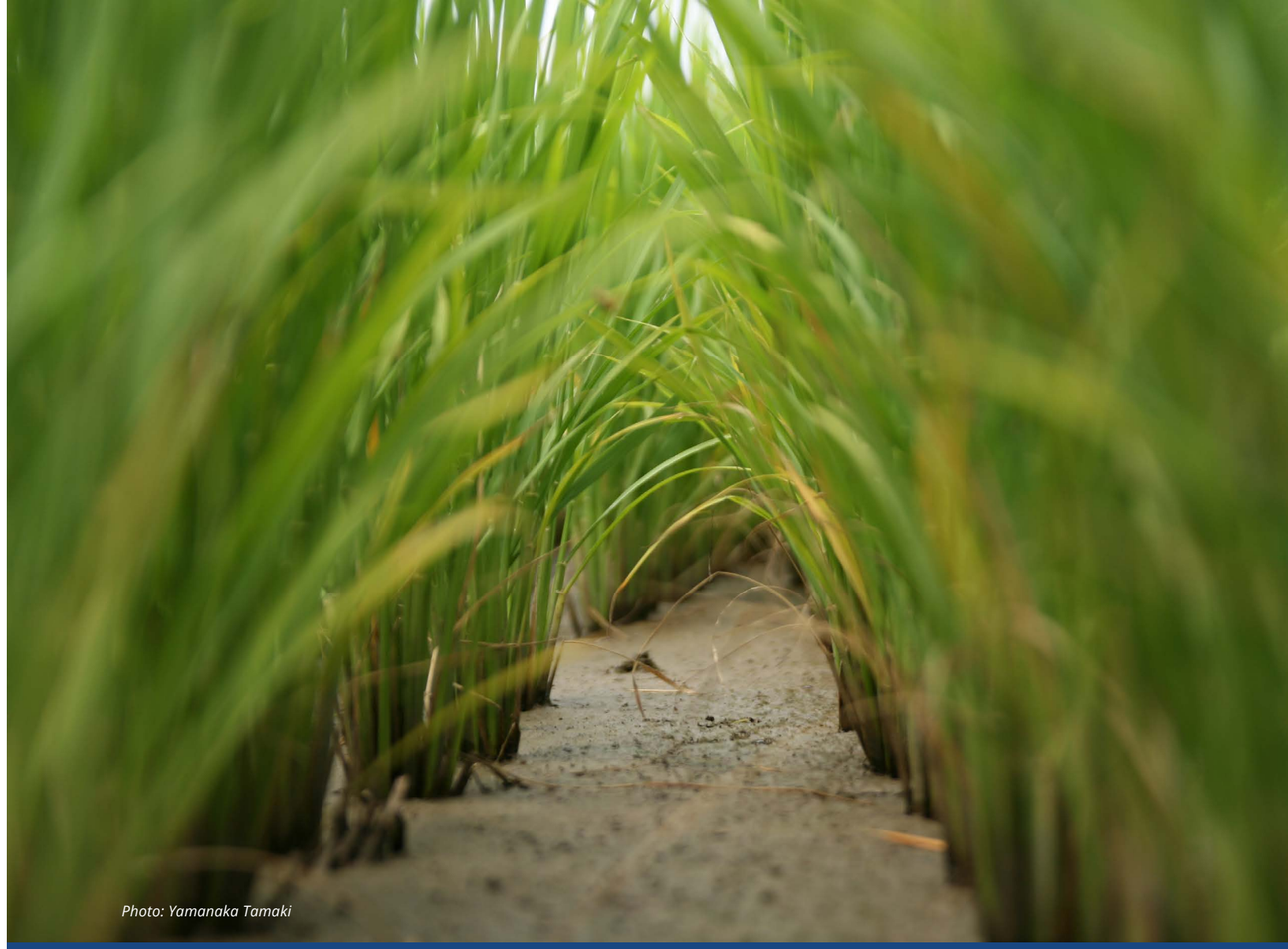


Photo: Yamanaka Tamaki

1 Stevens, G. A., et al. Micronutrient deficiencies among preschool-aged children and women of reproductive age worldwide: a pooled analysis of individual-level data from population-representative surveys. The Lancet Global Health. 2022.

2 Daru, J., et al. Risk of maternal mortality in women with severe anemia during pregnancy and postpartum: a multilevel analysis. The Lancet Global Health. 2018.

3 World Health Organization. The global prevalence of anemia in 2011. 2015.

4 Horton, S. and J. Ross. The economics of iron deficiency. Food Policy. 2003.

5 Black, R., et al. Maternal and child undernutrition and overweight in low-income and middle-income countries. The Lancet. 2013.

6 Blencowe, H., et al. Estimates of global and regional prevalence of neural tube defects for 2015: a systematic analysis. Annals of the New York Academy of Sciences. 2018.

7 Beckett, E., et al. Reduced plasma homocysteine levels in elderly Australians following mandatory folic acid fortification: a comparison of two cross-sectional cohorts. Journal of Nutrition and Intermediary Metabolism. 2017.

8 Kancherla, V., et al. A global update on the status of prevention of folic acid preventable spina bifida and anencephaly in year 2020: 30 Year anniversary of gaining knowledge about folic acid's prevention potential for neural tube defects. Birth Defects Research. 2022.

9 Keats, E., et al. Improved micronutrient status and health outcomes in low- and middle-income countries following large-scale fortification: evidence from a systematic review and meta-analysis. American Journal of Clinical Nutrition. 2019.

Suggested citation: Food Fortification Initiative. 2023 Annual Report. FFI: Atlanta, USA 2024. Accessed at: https://www.ffinetwork.org/annual-reports

ENSURING EVERY POUND OF INDUSTRIALLY PROCESSED GRAIN IS FORTIFIED WITH NUTRIENTS IS A GOAL WITHIN OUR SHORT-TERM REACH. IT IS ONLY POSSIBLE WITH COLLECTIVE ACTION.

Food Fortification Initiative
Enhancing Grains for Healthier Lives

Photo: Children at play in Uganda. (EUECHO/ Edward Echwalu)