Identifying Appropriate Delivery Options for Fortified Rice

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Key Messages

- To identify the optimal delivery option for fortified rice, decision-makers should assess the public health need, the rice supply chain, the feasibility of rice fortification and the extent and scale to which social safety nets reach groups that can most benefit from rice fortification.
- Mandatory rice fortification offers the best opportunity to maximize the public health benefit afforded by rice fortification.
- When the rice milling landscape is fragmented and mandatory fortification is not feasible, the fortification of rice distributed through social safety nets is an alternative to achieve public health impact in targeted populations.
- The main challenges identified for a sustainable mandatory rice fortification are: very high initial investment to develop a high-quality fortified kernel industry and implementation of an effective regulatory system.

Introduction

Where rice is an important staple food, rice fortification has the potential to significantly contribute to the reduction of micronutrient deficiencies in a population. Rice is estimated to be a staple food for over 3.5 billion people, half of the world's population. Its consumption had traditionally been concentrated in Asia but is now increasingly important in Latin America and sub-Saharan Africa.[1] Fortified rice can reach consumers through three different delivery options. First, governments can mandate that all rice on the market be fortified. Alternatively, rice millers can voluntarily fortify rice in response to market demand. Third, fortified rice can be made available through social safety net programs. The distribution of fortified rice through social safety net systems can occur alongside either mandatory or voluntary rice fortification. Selecting the most appropriate delivery option depends on public health need, context and the intended objective and purpose of rice fortification.

This article provides an overview of the three potential delivery channels for fortified rice, the lessons learned from implementing countries and the current status of rice fortification.

> "Fortified rice can reach consumers through three different delivery options"

Delivery Option 1

Mandatory fortification

Mandatory fortification requires food producers, both of domestic and of imported food, to fortify the particular staple food or condiment with specified micronutrients. In comparison with other delivery options, experience shows that mandatory fortification has the greatest potential for public health impact.[2] If a food is commonly consumed by all segments of the population, mandatory fortification of that food will result in increased micronutrient intake without requiring behavior change. Governments tend to institute mandatory fortification when the prevalence or risk of

TABLE 1: Status of mandatory rice fortification, by country

Country	Legislation year	Rice source, fortified kernel source, and milling industry	Status
Costa Rica	2001	40% imported; two domestic fortified kernel producers; 11 mills	100% fortified
Nicaragua	2009	80% rice domestically grown; 40+ mills, many small	Not yet being implemented
Panama	2009	40% rice imported; initial plan for government to pay for kernels	Not yet being implemented
Papua New Guinea	2007	All rice imported; fortified with imported kernels or in country of origin	At least 80% fortified
Philippines	2001	13% imported; ~11,000 mills	1%–2% total rice fortified in 2006–2013. Currently <1%
United States	1958	All domestic rice fortified, likely with dusting technology	70% fortified

micronutrient deficiencies are widespread, and when a suitable food vehicle that is consumed by the majority of the population can be effectively fortified.[3] Mandatory fortification requires considerable government will, advocacy and leadership to create the necessary legislation and enforcement system.

Current status of mandatory fortification

Six countries have mandatory rice fortification legislation, but only three – Costa Rica, Papua New Guinea and the United States – are effectively implementing their legislation as the remaining countries have reported challenges and experienced constraints (**Table 1**).[4]

Costa Rica has the most successful mandatory rice fortification program, with 100% of rice fortified. Costa Rica also mandates fortification of other staple foods such as wheat and maize flours, milk and oil, to reach all population segments with all necessary micronutrients. Through this 'fortified food basket' approach, significant declines in iron deficiency anemia[5] and neural tube defect rates[6] have been achieved, but it is not possible to know the attribution to rice fortification alone.

Approximately 80% of rice in Papua New Guinea (PNG) is fortified; implementing rice fortification is logistically facilitated in PNG by the fact that almost all rice is imported by a small number of rice importers rather than domestically grown. However, although rice importers are indeed importing fortified rice, there are indications that some are using dusted rice which has high nutrient losses when washed.

The United States is the third country successfully implementing mandatory rice fortification. Federal legislation requires that rice must be fortified if it is produced in, goes to, or passes through, a state with mandatory legislation. Six of the US's 50 states[7] have mandatory legislation and have effectively leveraged their legislation so that an estimated 70% of the US rice supply is fortified.[8] However, rice is fortified using a dusting technology, as evidenced by mandatory labeling advising consumers to avoid washing rice before cooking.[9]

The other three countries with mandatory fortification have struggled to operationalize and enforce rice fortification. The Philippines passed mandatory legislation in 2001 and has undertaken significant planning and investment for rice fortification, yet less than 1% of total rice is currently fortified. Despite significant efforts by the government, the private sector never started rice fortification on a large scale, primarily due to a fragmented rice milling industry landscape and the low fortification capacity of the thousands of small millers.

Similarly, the governments of Nicaragua and Panama are not actively enforcing their rice fortification legislation.[10] Again, these countries are hampered by the high fragmentation of the rice milling industry and low industry capacity for fortification. In Panama discussions are in progress to update the rice fortification law in order to improve feasibility for the private sector. In Nicaragua there is a recognized need to improve local capacity to monitor and regulate fortified rice. Lacking appropriate monitoring and regulation, efforts have been made to quantify the prevalence of folate deficiency in women of childbearing age, as well as to develop social marketing materials to create consumer demand (similar to a voluntary fortification model). These three countries illustrate the need for appropriate legislation that reflects the feasibility for the private sector to implement rice fortification.

Lessons learned from mandatory fortification

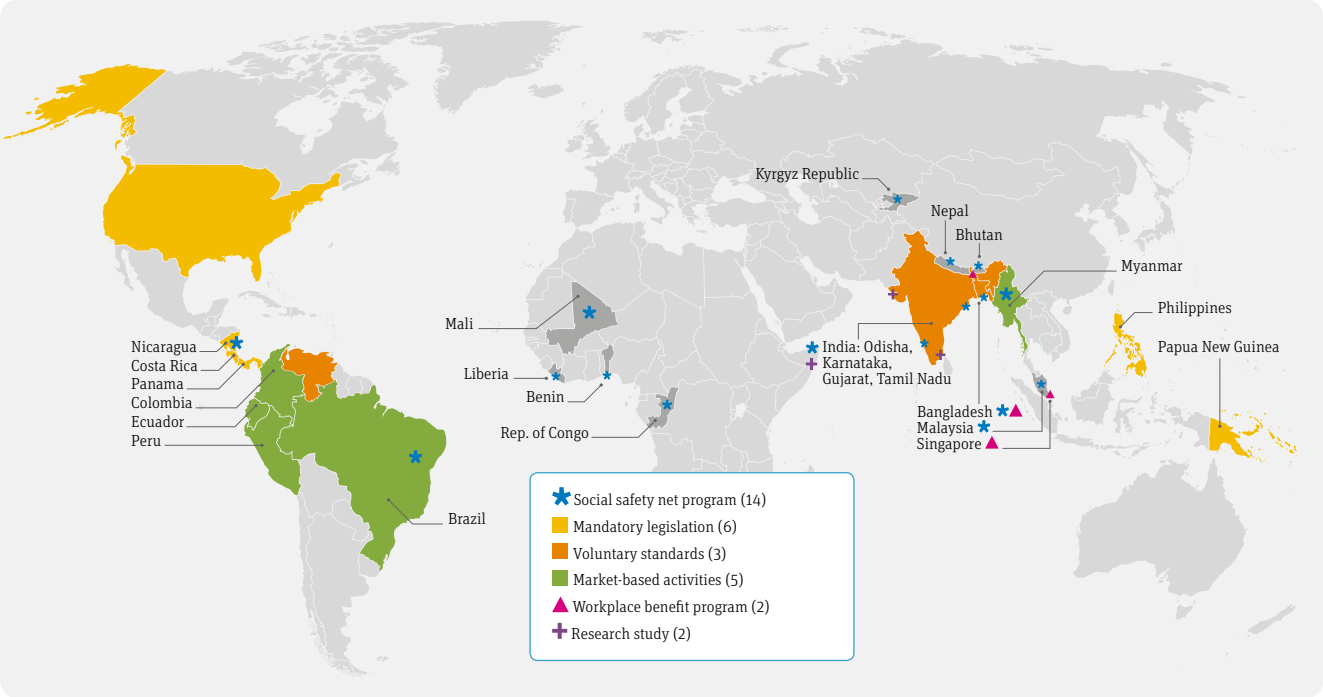
Mandatory fortification provides the greatest opportunity for large-scale, sustainable public health impact

Although there are few mandatory rice fortification programs being implemented today, extrapolating from rice fortification efficacy studies and lessons learned from other staple food fortification (e.g., wheat flour) and condiments (e.g., salt) there is every reason to believe that mandatory rice fortification would be an effective and also cost-effective strategy to improve micronutrient intake. Costa Rica is considered the country with the most successful rice fortification program globally, with an estimated 100% of the national supply of rice fortified.[11]

Political will is necessary to establish mandatory fortification

Political will and commitment are key for passing national legislation requiring the addition of specific micronutrients to the

FIGURE 1: Global status of rice fortification programs



Credit: FFI database, updated May 2018

identified food, and for setting national standards. Thereafter, continued political will and government capacity are necessary to resource and implement regulatory monitoring systems for effective enforcement of the legislation and standards.

The degree of industry consolidation, size and modernization contributes to the success of rice fortification

In many rice-producing countries, rice milling has traditionally been done on a very small scale, such as one mill per village. Today, the global industry is slowly modernizing and consolidating. Mandatory rice fortification will be most feasible in countries where there is a consolidated rice milling or rice-importing industry. In countries such as the Philippines, and perhaps a lesser extent, Nicaragua, the fragmented milling structure has been a significant constraint to the implementation of mandatory rice fortification legislation.

As with all mandatory food fortification programs, mandatory rice fortification programs are only effective when enforcement is in place

Comprehensive legislation and strong enforcement create an enabling environment to ensure a sustainable and cost-effective supply of fortified rice. Legislation, once passed, must be enforced. However, generating sufficient political will, manpower and resources to effectively enforce the legislation has been challenging in half of the countries with mandatory rice fortification legislation. Enforcement and regulation function to level the playing field and provide the private sector with the assurance that their competitors will incur the same costs. These measures also ensure the fortification of the entire rice supply.

Mandatory fortification has minimal impact on consumer pricing

When fortified rice is mandated, consumers do not need to choose between fortified and non-fortified rice, as all the rice on the market will be fortified. Therefore, consumers do not have to change their buying habits and will not have to pay a premium price for fortified brands. In this scenario, rice millers will most probably pass on the additional costs of fortification to consumers. These costs are likely to be minimal and will be shared across all the rice available in the market. In fact, the increased cost may be so negligible as to be unnoticed by the average consumer. In some contexts, the government may choose to pay for the cost of fortification, or millers may choose to not pass on fortification costs to consumers.

Industry investment is necessary to develop domestic capacity for fortified kernel production

The volume of fortified kernels required to fortify a country's rice supply is considerable. Therefore the associated transport costs of importing fortified kernels can be prohibitive. On the

other hand, investing in a domestic fortified kernel production facility is expensive and potentially risky: private companies interested in investing in fortified kernel production will need to be confident that national governments will enforce the legislation and that millers will comply with it. Alternatively, fortified kernel producers outside the country will only significantly increase their production capacity and be in a position to sell their products at rates that compensate for transport costs if they believe that there will be a sustained market for their fortified kernels. Millers also need to make investments in feeder and blending equipment and to purchase fortified kernels. Prior to developing domestic capacity for kernel production, players in the supply chain will need to compare the relative costs of domestic fortified kernels versus imported kernels and evaluate the government's political will, manpower and resources.

Marketing, including communication for behavior change, is not necessary to influence purchasing decisions when rice fortification is mandatory

When mandatory legislation is in place and enforced, marketing and communication costs are minimal. It remains important to inform consumers that their rice is now fortified and to provide labeling that indicates the type and level of the additional nutrient content. There is no need, however, for either rice producers or the government to undertake costly social marketing to encourage people to purchase fortified rice.

Delivery Option 2

Voluntary fortification

Fortification is voluntary when the private food industry has an option whether or not to fortify products. Voluntary fortification is a business-oriented approach with fortified food products marketed as 'value-added' products often targeted at higher-income consumers. If millers perceive a current, potential or emerging demand for fortified rice, they may choose to develop a fortified brand to capture new market share and increase sales. However, due to slow build-up of consumer demand, especially among poorer populations, the potential for going to scale and influencing a population's micronutrient health may be limited. Impact will also be limited as lower socioeconomic groups, who are most in need of fortification, are least likely to purchase fortified brands due to their higher cost. Voluntary approaches to rice fortification have not yet been systematically evaluated to see if a health impact has been achieved.

Status of voluntary fortification

Few countries have voluntarily fortified rice consumed by a significant proportion of the population, although several countries have fortified rice available in the marketplace in a limited capacity. As an example, in Colombia voluntary fortification by a small number of rice millers with a major market share has led to about 35% of the national rice supply being fortified. Unfortunately, Columbian millers use a rice fortification method (spraying) that has unclear nutrient retention after washing and cooking, which could reduce the attendant public health benefit.[12] In Brazil,[13] implementation has not been achieved at large scale (only an estimated 1%–4% of rice is fortified) because rice millers are fragmented and consumer motivation to purchase the premium-priced rice brands is low. In Mali, a Malian rice milling company, Malô, plans to enter the rice fortification industry by broadening its fortified kernel blending operations to include expansion into domestic fortified kernel production. Future plans are to produce a premium fortified rice brand for the local market. See Case Study: Mali on p. 94 and A Day in the Life of Salif Romano Niang on p. 76.

Lessons learned regarding voluntary rice fortification

It is difficult to achieve broad public health impact

Voluntary rice fortification has not achieved high and sustained coverage of the total rice supply in any country where voluntarily fortified rice is known to be available in the marketplace; even in Colombia, where an estimated 35% of the rice is fortified voluntarily by millers,[14] this coverage is relatively low compared to what has been achieved in mandatory fortification settings. If fortified rice is not easily accessible across the entire range of common market channels (for example, bulk sales, local markets), and in particular those most frequently used by the most poor and vulnerable populations, the health benefits will be limited.

Standards are necessary, even in voluntary fortification

Voluntary rice fortification also requires appropriate standards for rice fortification. In Colombia, as there is no fortification standard, millers are able to fortify with nutrients and at levels as they wish, using an untested fortification method. Even in voluntary fortification settings, fortification standards are recommended so that millers have guidance in fortifying at levels that will be consistent and intended to improve public health. Standards can also specify the necessary technological requirements of fortified rice, e.g., nutrient retention levels after washing or cooking. The lack of effective voluntary standards in Colombia has enabled rice producers to market fortified rice that is unlikely to provide nutritional benefit.

Government regulations and enforcement are still necessary in a voluntary system

Although the private sector determines whether to fortify, governments still have a significant role to play in setting standards and regulations for fortification.[15] In the context of voluntary fortification, governments also have to undertake compliance

monitoring and enforcement so as to ensure that fortified products meet national standards, that they are safe and correctly labeled and that unsubstantiated health claims are not made.

Fortified rice brands are likely to be more expensive

Millers will typically raise retail prices to cover the increased costs of manufacturing and marketing fortified brands. If the fortified rice brands are being sold as value-added products, the price increase may be in excess of production and marketing costs as producers will often position the fortified rice as a luxury product. In markets where bulk, unbranded rice is still a common way to purchase rice, voluntarily fortified rice is unlikely to be sold in this way since millers have no ability to market or brand their product. Fortified rice sold only as branded packages thus may lose a group of consumers who purchase rice at their local markets through bulk or unbranded containers.

Increased marketing (i.e., advertising, promotion and packaging) is needed to promote the benefits of the fortification and the premium pricing – but still may not be enough

Contrary to popular belief, marketing and social mobilization campaigns aimed at encouraging consumers to purchase fortified foods, including fortified rice, have failed to result in sustained consumption across a population. Extensive investments in social marketing under a purely voluntary commercial approach in Brazil did not result in increased consumer demand for fortified rice.[16] Voluntarily fortified rice is typically produced to appeal to higher-income consumers and as part of an effort to build a reputation as a premium rice brand.

Delivery Option 3

Fortification of rice distributed through social safety nets

Targeting rice fortification to certain populations that are more likely to be nutritionally vulnerable can be achieved by fortifying rice distributed through social safety nets such as school feeding programs, conditional or unconditional distributions to the poor or to vulnerable groups, and food assistance during emergency situations. Subsidies and vouchers for fortified rice are also a possibility but require that fortified rice be easily available to beneficiaries in their usual marketplaces. Fortifying rice distributed in social safety net programs reaches the most vulnerable populations and thus has the potential to make a significant impact on public health. The fortification of rice distributed through social safety nets can be implemented in parallel with mandatory or voluntary fortification. Theoretically, experiences in fortifying social safety net rice may also potentially sensitize policymakers and governments to consider mandatory rice fortification – although this has not yet occurred in practice.

Status of fortification of social safety net rice

Several countries in West Africa have government-run programs, supported by partners, which distribute fortified rice as part of a social safety net program.

During 2018, the United States Department of Agriculture's McGovern-Dole Program provided fortified rice in partner-supported school feeding programs in Benin, Liberia and Republic of Congo, as well as in Nicaragua, Kyrgyz Republic and Nepal (2018 volumes not yet confirmed). In 2017, the same program donated approximately 9,000 metric tons across its global programs. In 2016, WFP distributed 15,500 metric tons of fortified rice in Niger, Mauritania and Chad through the United States Agency for International Development's Food for Peace Program.

In Mali, WFP has partnered with Malô to blend imported fortified kernels into locally produced rice to provide fortified rice for WFP's school meals. WFP is using the Malô experience as a logistics pilot to understand how cost-effective this type of model of producing fortified rice through imported kernels domestically blended could be in a West African context as well as to evaluate if it could be replicated elsewhere in WFP's food distribution programs.

Fortified rice is also featured in other social safety nets across Asia, most prominently in school feeding programs across India and government programs in Bangladesh.[18]

Lessons learned from fortification of rice distributed through social safety nets

Social safety net programs that include rice distribution offer a good opportunity to target fortified rice to those most in need

The school cook preparing fortified rice for the children in Mali

Mandatory rice fortification will be most feasible in countries where there is a consolidated rice milling or rice-importing industry. The domestic rice milling industry is growing in Senegal and may present opportunities for rice fortification.

In situations where mandatory fortification is not possible, social safety nets may be the only delivery option for fortified rice that will achieve a public health impact. However, the public health impact will be limited to the beneficiaries of the social safety net. Barriers to adding fortified rice to an existing social safety net program include supply chain difficulties in incorporating fortified rice, additional cost to be borne by governments or donors to purchase and blend fortified rice, and the need to ensure adequate sensitization of the recipient population in order to ensure adherence.

A young girl in Mali participating in a WFP program

Enforcement and regulation

The fortification of rice distributed through social safety net programs is unlikely to require national legislation but it will require the social safety net implementer to make a policy decision and to establish or adopt a standard for fortified rice supplied in the social safety nets.

The social safety net implementer typically bears the cost of fortification

Social safety nets are most often funded and implemented by the government, often with support from partner organizations. Rice millers and manufacturers will be invited to bid to supply the program. These private-sector agents will have a guaranteed market with low risk, at a price that covers their increased manufacturing costs for a defined period of time. As the social safety net implementer is bearing the cost of fortification, the consumer will not be faced with a price increase.

Fortification costs may be substantial

Although the fortification manufacturing cost will be a small percentage of the overall program operation expense compared to the costs of procurement and distribution, the initial capital costs and recurring costs may still be considerable. In mandatory fortification programs the cost of fortification is shared by all consumers and possibly millers, whereas in social safety net programs the cost of fortification is often borne by the program funder.

Logistical issues may impede implementation

Although there has been limited experience with using fortified rice in a large-scale social safety program in West Africa to date,

social safety net programs in other regions have experienced logistical difficulties such as sourcing rice for distribution, contracting millers to blend and sourcing fortified kernels. There is also an increasing trend in social safety net programs toward cash transfers or vouchers, and there will be logistical challenges to ensure that fortified rice is available for beneficiaries to purchase in these programs. Challenges also exist in the implementation of large-scale social safety net programs themselves, including ensuring adequate management and effective and efficient targeting.

No marketing is needed for fortified rice in a social safety net

The fortified rice is provided to the targeted population for free or at a subsidized price; the group targeted does not have a choice regarding the brand or type of rice supplied. However, as in all fortification programs, general awareness of the importance of fortification is helpful to preemptively address any potential consumer concerns about fortification.

Considerations for choosing the optimal delivery option

With the reliance on rice as a staple food throughout West Africa and the high prevalence of micronutrient deficiencies in the region, rice should be considered as a major fortification vehicle. The impact will be maximized if high coverage of fortified rice can be achieved in those population groups suffering from nutrient deficiencies. The choice of delivery option should be based on an analysis of the rice supply chain, an assessment of the feasibility of implementation in the given context and identification of the target group.

> "Mandatory rice fortification offers the best opportunity to reach the majority of people in a cost-effective and sustainable way. However, it is only possible under certain conditions."

Mandatory rice fortification offers the best opportunity to reach the majority of people in a cost-effective and sustainable way. However, mandatory fortification is only possible under certain conditions. Mapping the rice supply chain (see p. 68 for Tsang et al article on fortification opportunities in Africa) helps to assess the feasibility of mandatory rice fortification and should include an assessment of the proportion of rice that is milled in mills with fortification capacity, the extent of milling consolidation, the availability of warehouses where it might be fortified and the most sustainable and cost-effective sources of fortified kernels. If the analysis suggests mandatory rice fortification is feasible, information on the rice supply chain should be used to plan implementation. See article on Feasibility and Potential for Rice Fortification in Africa (p. 31).

Depending on the manufacturing and regulatory landscapes, voluntary fortification rarely achieves high population coverage and is unlikely to achieve a public health impact for the most vulnerable. Therefore, in places where mandatory rice fortification is not feasible, social safety nets that distribute rice offer a good opportunity for reaching the most vulnerable. Planners must analyze the feasibility of integrating fortification into the rice procurement, processing and distribution process of the social safety net program and estimate funding and quality assurance monitoring requirements. The efficacy and effectiveness of the fortified rice is dependent on how well the social safety net functions.

> "Social safety net programs are an excellent way of reaching vulnerable groups with fortified rice and they provide valuable manufacturing and distribution experience"

Conclusions

Mandatory rice fortification offers the best means of achieving high coverage of a population and hence a public health benefit. Past experience shows that voluntary rice fortification has not achieved high coverage in countries where voluntarily fortified rice is currently available. Social safety net programs that distribute rice are an excellent way of reaching vulnerable groups with fortified rice and they provide valuable manufacturing and distribution experience. Importantly, assessment of the feasibility of implementation is necessary for both mandatory and social safety net delivery options. A rice landscape analysis will provide essential information to assess feasibility.

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