



Micronutrient deficiencies in Mexico

Ironing out the kinks





This report has been written and researched by the Changing Markets Foundation in collaboration with independent researchers.

The purpose of the report is to shed light on industry-specific issues related to fortification of flour products in Mexico. The information in this document has been obtained from sources believed reliable and in good faith. The authors accept no liability whatsoever for any direct or consequential loss arising from the use of this document or its contents.

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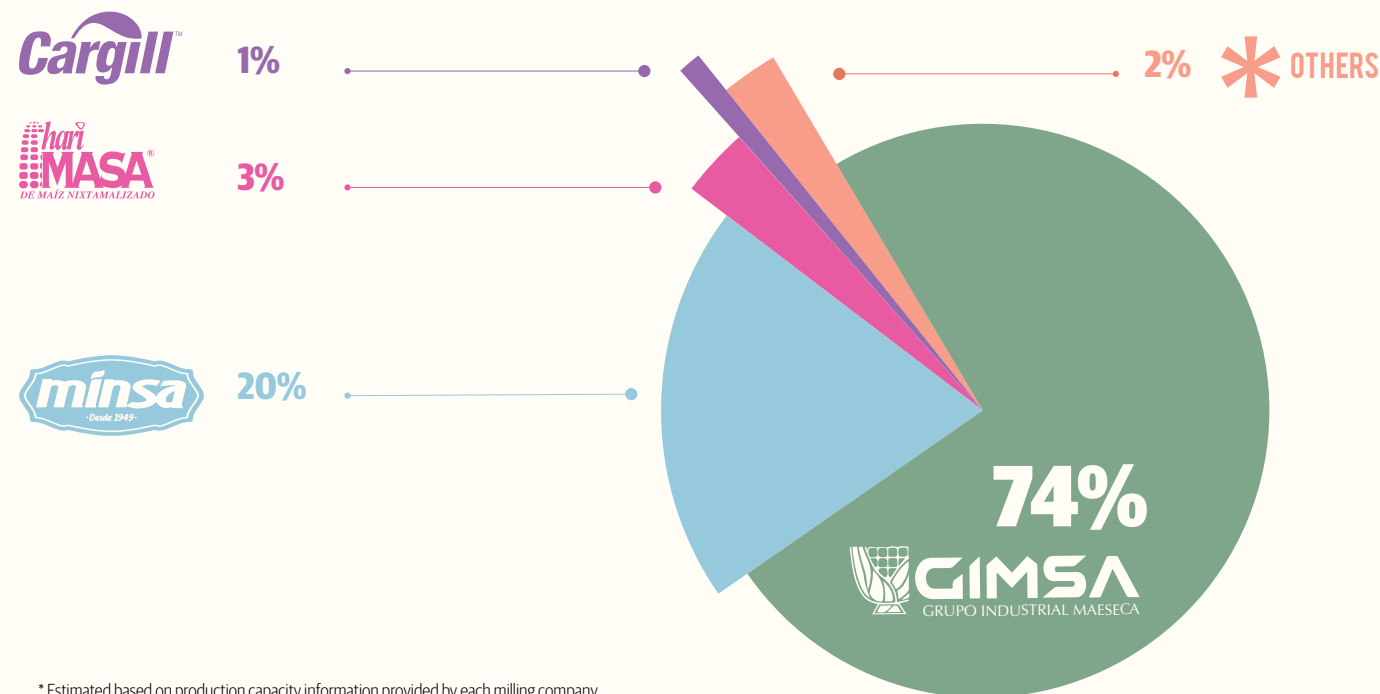
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Summary

Iron deficiency and anaemia are important public health concerns in Mexico. Given the ubiquity of maize flour in the staple diet of the Mexican population – maize represents 72% of the market share for grain consumed in Mexico – flour fortification is an obvious solution to this national health crisis. Indeed, current Mexican legislation on flour fortification recommends companies use certain iron compounds to fortify flours, and the World Health Organization (WHO) sets out clear guidelines on iron sources to ensure fortification programmes are effective. However, our study shows that major brands of maize flour consumed in Mexico – including Maseca, Hari Masa and Walmart's own brand – are not using the recommended type of iron to fortify their flour. It is very concerning that companies are choosing to ignore the recommendations when the effective fortification of flours could have a significant impact on improving people's health. This report sets out the problem, reports on the findings of our investigation into the type of iron used to fortify flours in Mexico, and offers recommendations to the Mexican government, flour-milling industry and supermarkets to tackle this public health crisis.

THE FLOUR MARKET IN MEXICO 2017

Market share of major maize-flour producers (%)*



* Estimated based on production capacity information provided by each milling company.

1. Iron deficiency and anaemia in Mexico: How big is the problem?

Mexico faces a nutritional deficit that impacts on individuals' health and the productivity of the population as a whole. Shockingly, 90% women are not getting enough iron in their diet,¹ and a quarter of children and one in five pregnant women suffer from anaemia, with at least half of these cases attributable to micronutrient deficiency.²

To tackle this nutritional crisis, efforts must continue to ensure the whole population can access varied, healthy, balanced diets. At the same time, food fortification is one effective complementary tool to address micronutrient deficiencies. There is already legislation in Mexico that obliges flour companies to fortify nixtamalized maize and wheat flours with iron, zinc, folic acid and other B vitamins; however, our previous research has highlighted significant gaps in monitoring and enforcement, and raised questions about how the law is being implemented.³

Anaemia rates in Mexico fell steadily from 1999 to 2012, but recent studies show that since then they have increased among all age groups, with an almost 7% increase among women of child-bearing age.⁴ The severity of this problem cannot be overstated - evidence shows that if micronutrient deficiency-caused anaemia is not detected and resolved before a child reaches two years old, the damage to healthy physical and mental development becomes irreversible.⁵

Considering how maize and wheat flour form integral parts of most Mexicans' diets, fortification should help to tackle iron deficiency and nutritional anaemia. This briefing therefore further delves into the Mexican flour industry, investigating how it is implementing its legal obligations, with an emphasis on iron fortification.

2. The flour industry in Mexico

Mexicans eat, on average, nearly 20 million metric tonnes of wheat and maize every year.⁶ Maize makes up 72% of this figure; Mexicans consume almost three times as much maize as wheat.⁷ Maize and tortillas account for an average of 8.3% of total food expenditure per Mexican household.⁸ Further, for people living in rural areas, tortillas made from maize flour provide an estimated 65% of their dietary nutrients.⁹

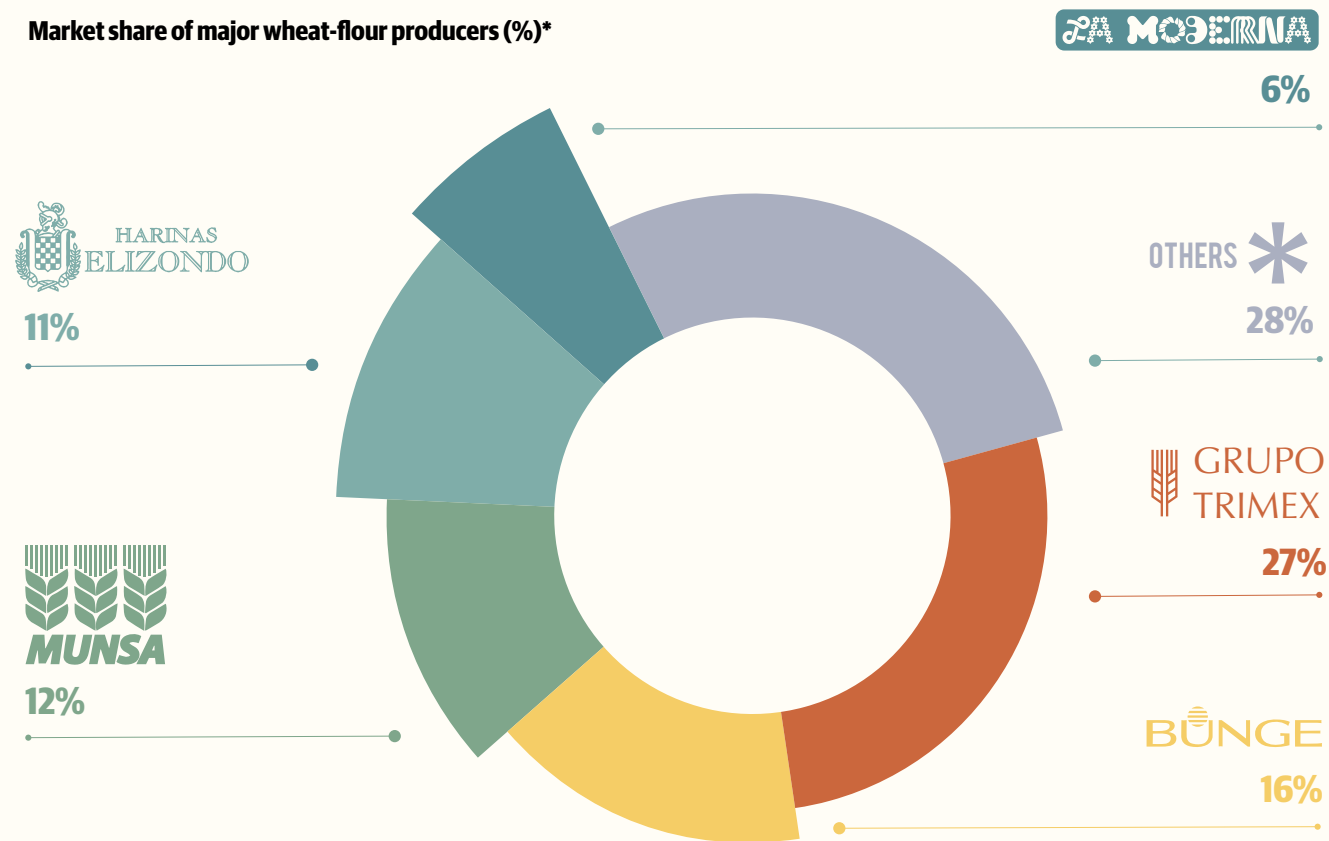
Maize plays an integral role in the Mexican diet and culture. It has been a staple food and a principal crop cultivated by farmers in Mexico for millennia. However, analysis suggests that, while historically Mexicans have preferred maize tortillas over bread, wheat consumption per capita has steadily increased over the past 10 years.¹⁰ Wheat bread is thus also a staple in the Mexican diet, and white bread makes up 70-75% of bread consumption.¹¹

A number of Mexican and multinational companies operate flour mills and produce maize and wheat flour in Mexico. Mexican legislation is clear: the obligation to fortify wheat and maize flours lies with industrialised flour producers.

3. Recommended iron sources

The source or compound of iron used in fortification can have a significant impact on the nutritional value of the iron.¹² **Bioavailability** is the ease and speed with which a substance is absorbed into the bloodstream, and our bodies simply do not absorb some iron sources well (**low bioavailability**). The choice

Market share of major wheat-flour producers (%)*



* Estimated based on production capacity information provided by each milling company.

of iron compound used to fortify flour is a compromise among bioavailability, cost and the changes to texture, taste, smell and/or colour when the compound is added to food. Recommended levels of added iron also differ depending on the compound used.

When fortifying flour made from grains, the bioavailability of different iron compounds is affected by the **extraction rate** (the amount of grain converted to flour). **High-extraction flour** is a wholemeal or wholegrain flour that has been milled to retain a high percentage of the grain. High-extraction or wholegrain flours are naturally high in phytates, which inhibit iron absorption in the human body; as such, iron compounds with low bioavailability are often not recommended for the fortification of these types of flours. **Low-extraction flours** are white or refined flours, in which fewer components of the grain remain in the flour after milling; these flours therefore have lower levels of iron-inhibiting phytates.

The selection of the type and quantity of iron to add to flour lies with national decision makers and should be viewed in the context of each country’s situation. However, the World Health Organization (WHO) guidance on fortification provides recommendations to governments and food producers seeking to ensure they are appropriately fortifying foods with the recommended iron sources, and that their processes are fit for purpose.¹³

Table 1: WHO recommendations for iron compounds to use in wheat-flour fortification¹⁴

Type of flour	Extraction rate	Recommended iron compound
Wheat	Low (white flours)	NaFeEDTA (ferric sodium ethylenediaminetetraacetate)
		Ferrous sulphate
		Ferrous fumarate
		Electrolytic iron*
	High (wholegrain or wholemeal flours)	NaFeEDTA (ferric sodium ethylenediaminetetraacetate)

* Electrolytic iron is only recommended for low-extraction (i.e. white) wheat flour if the estimated average daily consumption of wheat flour per person is above 150g.

Elemental iron powders, such as reduced iron, are generally not recommended for food fortification because of poor absorption.¹⁵ However, analysis that informed the 2009 WHO guidelines for wheat flour points out that flour manufacturers in the majority of countries still use non-recommended, low-bioavailability iron powders. Unless flour is fortified with adequate levels of recommended iron compounds, fortification programmes are unlikely to be effective.¹⁶

In 2016, the WHO issued updated guidelines for maize-flour fortification, which clearly state that electrolytic iron is not recommended for high-extraction (i.e. wholegrain) maize flour. **Nixtamalization** is

a common process in Mexico in which the maize is treated with quicklime; this is the type of flour used for making tortillas. The nixtamalization process yields high-extraction flour, as the process does not fully destroy the natural phytates present in the grain. Additionally, the quicklime solution is an alkaline environment, which further reduces the effectiveness of iron absorption in the human body. Electrolytic iron is therefore not effective in the fortification of maize flour that is deemed to be nixtamalized.¹⁷

Table 2: WHO recommendations for iron compounds to use in maize-flour fortification¹⁸

Type of flour	Extraction rate	Recommended iron compound
Maize flour	Low (refined flours)	NaFeEDTA (ferric sodium ethylenediaminetetraacetate)
		Ferrous sulphate
		Ferrous fumarate
		Electrolytic iron*
	High (wholegrain or wholemeal flours, including nixtamalized flour)	NaFeEDTA (ferric sodium ethylenediaminetetraacetate)
		Ferrous sulphate
		Ferrous fumarate

* Electrolytic iron is only recommended for low-extraction (i.e. refined) maize flour if the estimated average consumption of maize flour per person is above 150g per day.

While Mexican legislation does not *obligate* the use of specific iron compounds in the fortification process, it does make *recommendations*, based on scientific evidence, of the best iron sources with which to fortify flour products. In law NOM-247-SSA1-2008, which came into force in 2010, the recommended iron compounds for fortification of wheat and maize flour are either ferrous sulphate or ferrous fumarate.¹⁹ However, the legislation should be brought closer into line with the more recent WHO guidelines; for example, listing NaFeEDTA as the recommended iron compound for wholegrain wheat flour, and clearly stating that electrolytic iron should not be used to fortify nixtamalized maize flour.

With inadequate iron intakes among the Mexican population, the flour industry is responsible for the optimal delivery of fortification – an intervention that, when done well, can help tackle the serious consequences of iron deficiency.²⁰ Evidence clearly shows that using low-bioavailability iron sources can decrease the effectiveness of the fortification programme.²¹

Allowing companies to fortify flours with different iron sources at different levels makes it challenging to monitor adequate fortification content; clear labelling of flour, bread and tortilla packages is therefore essential. In Mexico, there is no comprehensive dataset on iron sources or iron levels used in flours sold at

retail level. The only data source relates to ad-hoc tests conducted by Mexican's public consumer agency, Procuraduría Federal del Consumidor, on a very limited number of samples in 2013, which showed a wide range of results for iron levels in some brands of maize and wheat flours.²² For this reason, we decided to conduct our own study of the iron sources used in the main brands of maize and wheat flours in Mexico.

4. Key findings on iron sources used by Mexico's biggest flour companies

Our study was based on an analysis of the information given on the labels of the most popular brands of flour available at retail level in Mexico City and Chiapas - areas chosen because they have the highest levels of anaemia in Mexico, and because Mexico City is the wealthiest region and Chiapas is the poorest.

The analysis focused on brands produced by wheat- and maize-flour companies with the biggest market share in Mexico. Supermarket chains, such as Walmart, Soriana, Chedraui and La Comer, are common retail outlets across Mexico, so the study also included several of the largest supermarket own-brand flours. The study included maize flour from brands Diconsa and DIF, which are only available in Diconsa shops - a publicly supported distribution network that aims to provide affordable, highly nutritional foods in the poorest, most remote areas of the country at low or no cost. It also included some imported brands of flours to see if these differed from those produced in Mexico.

While both Cargill de México and Bunge México are multinational companies with a stake in the Mexican flour market, they tend to produce flours for wholesale rather than retail, and were therefore not covered in this study. The wheat-flour market is more fragmented and many brands are regionalised. Such reasons could explain why our investigation did not find products from Munsa and Harinas Elizondo in Mexico City or Chiapas, despite the two companies having a notable share in the wheat flour market.

We emailed all major flour-milling companies to ask about their flour-fortification policies and how they comply with legislation, including which types of iron they use. To date, we have received no replies. The analysis was therefore based solely on the information provided on packaging labels.

Our findings indicate that most brands of refined white wheat flours use the recommended sources of iron to fortify their products. However, Tres Estrellas, Selecta, San Blas and La Perla brands also sell wholegrain flours that use ferrous fumarate as their iron compound. This adheres to recommendations in national law but not to the WHO guidelines, which state that ferrous fumarate is not effective wholegrain flours.

Wheat flour products from imported brands, and also the Aires del Campo brand, either do not include any statement regarding the fortification status of their products (i.e. Aires del Campo, 5 Stagioni or Bob's Red Mill) or do not specify which iron source they use (i.e. Pillsbury, owned by General Mills). This raises the questions of whether they are fortifying their flours at all, or if they are fortifying but are disregarding the legal requirement to state their nutrients and iron source on their product labels. The legislation does not exempt imported flours, raising questions about the government's monitoring of imported flour products. Either way, there is no excuse for multinational companies not to comply with Mexican fortification legislation.

The study of maize-flour labels tells a very different story. Mexican legislation is clear that ferrous fumarate or ferrous sulphate are the recommended iron sources to use in fortification, and more recently, WHO guidelines state that electrolytic iron is not a suitable compound for nixtamalized maize flour. Despite this, popular maize-flour products from major brands - including Maseca, Maizza, San Blas and own-brands from Walmart (i.e. Aurrerá), Soriana and Chedraui - continue to use electrolytic iron even though

the flour is nixtamalized. Furthermore, Hari Masa uses another form of iron which is not recommended due to poor absorption (i.e. reduced iron) and Maseca does not consistently list iron sources on all of its products, including Maseca Azul and Maseca Antojitos.

Minsa - the company with the second-largest market share - states that it uses the recommended ferrous fumarate to fortify its maize flour, as does the brand Guerrero. Maize flours from Diconsa and DIF also state they use the recommended iron source; these two brands are intended for the poorest people in Mexico.

Overall, eight out of twelve brands of maize flour were not using the recommended sources of iron (according to both the national legislation and the WHO guidelines). Four out of 17 brands of wheat flour were using the correct source of iron in their white flours but not in their wholegrain varieties (according to WHO guidelines), and four did not provide details of the iron compound used. Given the high levels of inadequate iron intake in Mexico and the serious health problems caused by iron deficiency and anaemia, it is concerning that companies are choosing to ignore legislative recommendations and the WHO guidelines.

Table 3: Types of iron in maize flour

Brand	Producer/owner/trader	Iron type	Following recommendations in Mexican law?	Following WHO recommended sources?
		Electrolytic iron	✗	✗
		Ferrous fumarate	✓	✓✓
		Reduced iron	✗	✗
		Electrolytic iron	✗	✗
		Electrolytic iron	✗	✗
		Electrolytic iron	✗	✗
		Ferrous fumarate	✓	✓
		Electrolytic iron	✗	✗
		Ferrous fumarate	✓	✓
		Ferrous fumarate	✓	✓
		Electrolytic iron	✗	✗
		Electrolytic iron	✗	✗

Table 4: Types of iron in wheat flour

Brand	Producer/owner/trader	Iron type	Following recommendations in Mexican law?	Following WHO recommended sources?
		Ferrous fumarate	✓	✓ (White) ✗ (wholegrain)
		Ferrous fumarate	✓	✓
		Ferrous fumarate	✓	✓
		Ferrous fumarate	✓	✓ (White) ✗ (wholegrain)
		Ferrous fumarate	✓	✓
		Ferrous fumarate	✓	✓ (White) ✗ (wholegrain)
		Ferrous fumarate	✓✓	✓
		Ferrous fumarate	✓	✓
		Ferrous fumarate	✓	✓
		Ferrous sulphate	✓	✓
		Ferrous sulphate	✓	✓ (White) ✗ (wholegrain)
		Ferrous fumarate	✓	✓
		Ferrous fumarate	✓	✓
		N/A	?	?
		Iron (unspecified)	?	?
		N/A	?	? (White) ? (wholegrain)
		N/A	?	?

5. Conclusion

This paper shows that at least eight companies that produce major brands of maize flour available at retail level are not using the recommended iron sources to fortify their products. This includes several supermarket own-brand flours. The maize-flour industry is highly concentrated, and the companies in question are producing a product that represents a big share in the staple diet of the majority of the population. Effective fortification of industrially produced maize flour could therefore have a significant impact on iron deficiency in the Mexican population.

Considering that iron deficiency and anaemia are serious health issues for many individuals in Mexico, it is unacceptable that companies like Maseca and Walmart are following neither the Mexican law recommendations nor the WHO guidelines. This lack of adherence is reducing the potential impact of flour fortification. It is also worrying that wholegrain wheat-flour products are not being fortified with the most bioavailable iron compounds, in line with the latest WHO guidelines. Moreover, imported wheat-flour products are not following the Mexican legislation regarding product labelling, which calls into question whether their products are actually fortified.

As highlighted in our previous report²³ and global research²⁴, regulatory monitoring at points of production and import, as well as at retail level, is vital to ensure products of adequate quality are made available to the population. Such monitoring also emphasises that industry and suppliers are accountable. If monitoring and enforcement of the fortification legislation is not sufficiently rigorous, it is questionable whether companies are doing enough to provide optimally fortified flours, tortillas and breads to the Mexican population. The flour-milling industry has an important responsibility to help tackle the serious problem of continuing micronutrient deficiencies.

6. Recommendations

Government

- Ensure the law is clear and unambiguous about the sources of micronutrients that should – and should not – be used to fortify flours. The law should be updated in line with the latest WHO guidelines on recommended iron sources for wholegrain wheat flours and nixtamalized maize flours.
- Update the legislation to include details of external monitoring and enforcement at mills, retail level and points of import. This should specify the frequency of monitoring, methods used and indicators of success. It should also provide details of enforcement incentives and sanctions for companies not fortifying their products correctly.
- Ensure the relevant government agency has the allocated budget, human resources and regular timelines to implement effective monitoring and enforcement.
- Ensure external monitoring and compliance data is made publicly available and accessible to civil society, consumers and industry.

Flour-milling industry

- Use the recommended sources of vitamins and minerals for fortification, as stated in the WHO guidelines and Mexican legislation.
- Clearly label packs of flour with iron sources and quantity used to fortify the product.

Supermarkets

- Demand that suppliers provide flour that is in line with Mexican legislation and fortified with the recommended sources and quantity of vitamins and minerals
- Maintain documentation on procurement of fortified flours for inspection by government officials.

Endnotes

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