



Corn Masa Market Assessment

Products and Fortification



**Food
Fortification
Initiative**

Enhancing Grains for Healthier Lives

Acknowledgements

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Food Fortification Initiative

The Food Fortification Initiative (FFI) champions effective grain fortification so people have the nutrients they need to be smarter, stronger, and healthier. The only global group that focuses exclusively on the world's most commonly consumed cereal grains (industrially milled wheat flour, maize flour, and rice), FFI helps country leaders plan, implement, and monitor sustainable, country-led fortification programs. FFI also tracks country and global progress in grain fortification. By engaging public, private, and civic stakeholders, FFI's data-driven approach effectuates large-scale change. Established in 2002, FFI is based at Emory University's Rollins School of Public Health.

Executive Summary

This market survey in two United States (US) areas with majority Hispanic populations in Texas and California sought to obtain a snapshot of the availability of folic acid fortified corn masa products in those areas. Ninety grocery stores were visited, and product entries were made for corn masa flour, corn tortillas, tostadas, taco shells, and tortilla chips with particular attention paid to fortification status. Retail corn masa flour bags comprise less than 7% of the total volume of masa in the US, but were the product most frequently found to be fortified. Twenty-one of forty-five (47%) unique corn masa flour bag types were labeled as being fortified with folic acid. Upon laboratory testing, all bags labeled as containing folic acid were found to contain folic acid. Fortified bags that listed a production location, 11 out of 14, were produced in Mexico. This suggests that the majority of fortified corn masa flour in the study areas is produced in Mexico and then imported. One of 77 unique tostada products and one of 167 unique tortilla products collected were labeled as fortified (confirmed with testing). The fortified products found in this assessment represent a small proportion of the corn masa products available in the market, suggesting that current corn masa fortification efforts are not reaching all consumers.

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List of Acronyms

- CA – California
- CDC – United States Centers for Disease Control and Prevention
- CMF – Corn masa flour
- FDA – United States Food and Drug Administration
- FFI – Food Fortification Initiative
- NTDs – Neural tube defects
- TX – Texas
- US – United States of America

Ethnicity Terminology

The US Census Bureau defines Hispanic or Latino as “a person of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin regardless of race.” This report uses the term Hispanic due to the usage of census data and the emphasis on communities of Mexican and Central American heritage.

Background

Neural tube defects (NTDs) are serious birth defects of the brain and spine that can cause severe disabilities and death. The most common NTDs are anencephaly and spina bifida (Figure 1) and are a result of failure of the neural tube to close during the first 28 days of pregnancy. Sufficient intake of folic acid (a man-made version of vitamin B9), prior to and during the first month of pregnancy can prevent 50%–70% of NTDs.^{1,2} Vitamin B9, also known as folate, is an essential micronutrient required for cell growth and DNA synthesis.

In 1992, the United States Public Health Service recommended all people capable of becoming pregnant consume 400 micrograms (mcg) of folic acid daily to reduce their risk of having a pregnancy affected by an NTD.³ In 1998, the US Food and Drug Administration (FDA) mandated fortification of enriched cereal grain products, such as bread and pasta, with 0.7 milligrams (mg) of folic acid per pound.⁴ This has resulted in a 36% decline in NTD-affected pregnancies per year, a decrease that has been maintained to date.⁵ Since this mandate, enriched cereal grains have become a major contributor of total folate to the American diet.⁶

Disparities in Neural Tube Defect Rates

Despite the decline in NTDs after mandatory folic acid fortification, Hispanic populations continue to have higher rates of NTD-affected pregnancies compared to non-Hispanic white and non-Hispanic black populations.⁷ A staple food in many Hispanic populations is corn masa flour (CMF), which was not included in the 1998 folic acid fortification policy. To address the health disparity, FDA allowed for voluntary folic acid fortification of corn masa flour in 2016.⁸

Impact of Voluntary Fortification of Corn Masa Flour

Studies to date have shown that voluntary folic acid fortification of CMF has not yielded any significant change in blood folate levels among Hispanic population.^{9,10} Additionally, studies conducted after voluntary fortification have shown only a marginal share of retail bags of CMF and corn tortilla products available in the US have been fortified with folic acid.^{11,12} In December 2017, a market study assessed the availability of folic acid fortified corn masa products in Atlanta, Georgia. Only 10% of CMF packages were fortified, and no corn tortillas were fortified.¹¹ In January 2019, a nationwide social media campaign (#FindFolicAcid) crowdsourced users to survey local stores for folic acid fortified CMF and corn masa products. Participants from 28 states shared photos of 43 unique items. Only three CMF packages were found to contain folic acid.¹² The Center for Science in the Public Interest used a food database to examine corn masa products for fortification, finding that 14% of CMF and 0% of other corn masa products were fortified with folic acid.¹³

An updated assessment of market availability of folic acid fortified corn masa products is needed, especially in communities with a high concentration of Hispanic individuals in the United States. This study aimed to assess the current availability of fortified masa products in retail food markets accessed by US communities where a majority of individuals identifying as Hispanic reside.

Figure 1. Most common neural tube defects are spina bifida and anencephaly.



Photo source: [WHO/CDC/ICBDSR Quick Reference Handbook](https://www.cdc.gov/ncbddd/ntds/quick-reference-handbook.html)

Methods

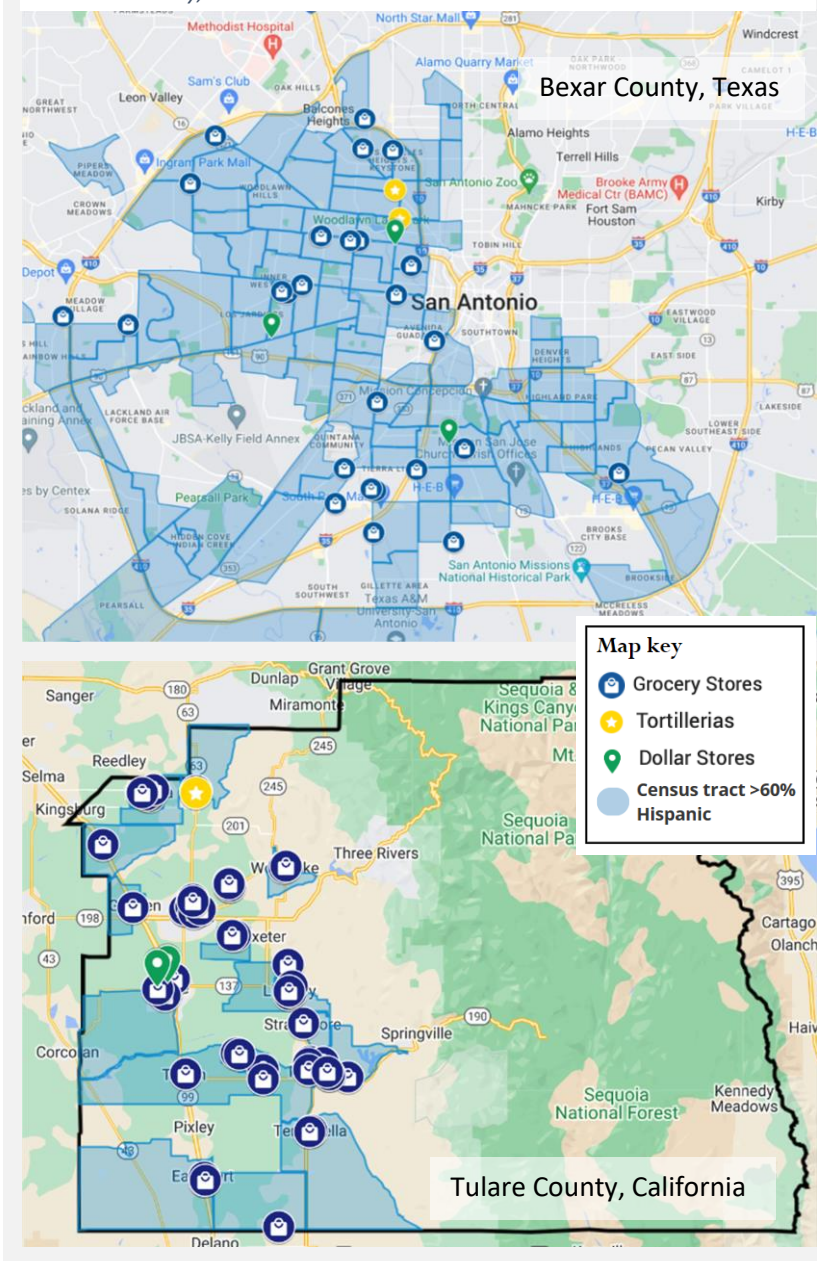
Selected Communities

This assessment focused on Hispanic communities with cultural ties to countries with significant consumption of corn masa products, specifically Mexico, Guatemala, El Salvador, and Honduras. Data from the US Census and American Community Survey were used to identify counties and census tracts with a large proportion of Hispanic individuals. To reduce the inclusion of products brought across the US-Mexico border, counties adjacent to Mexico were excluded. The two selected geographic areas have many census tracts with over 85% of the population identifying as Hispanic – Bexar County, Texas (metro San Antonio) and Tulare County, California (southeast of Fresno, CA). There were multiple California counties eligible based on these criteria, but Tulare County had the highest proportion of Hispanic populations and contains both urban and rural areas.

Selected Stores

A minimum of 20 grocery stores per county was determined necessary for sufficient statistical power. Stores were identified using Google Maps. Lists of active grocery stores were also requested from the counties. Online images helped verify whether stores were operational and sold grocery products. The initial selection criteria using census tracts with 85% Hispanic population cutoff did not yield enough stores, so the cutoff was lowered to census tracts with over 60% Hispanic populations. Additionally, based on the assumption that shopping patterns extend beyond residential census tracts, stores falling immediately outside the targeted census tracts were also surveyed. Figure 2 depicts the census tracts and surveyed store locations in both Bexar County, Texas, and Tulare County, California. Efforts were made to include diverse store types such as convenience stores, dollar stores, Hispanic grocery stores, local chains, and national chains.

Figure 2. Map of targeted census tracts and surveyed stores in Bexar County, TX and Tulare County, CA



Data Collection Training and Process

The Centers for Disease Control and Prevention (CDC) Epi Info™ for Mobile tool was used for data collection. Questionnaires were based on previous forms used by the CDC's Division of Birth Defects and Infant Disorders (DBDID). Forms were updated for this data collection (see final questionnaires in Annex A). FFI worked with DBDID to conduct training for the data collection teams in Bexar County, Texas (Texas Department of State Health Services and FFI staff) and in Tulare County, California (County Health Department staff). The data collection teams received training on data collection procedures, including how to use the Epi Info data collection tool, as well as lists of grocery stores and their corresponding locations on Google Maps. Data were collected between December 2023–March 2024.

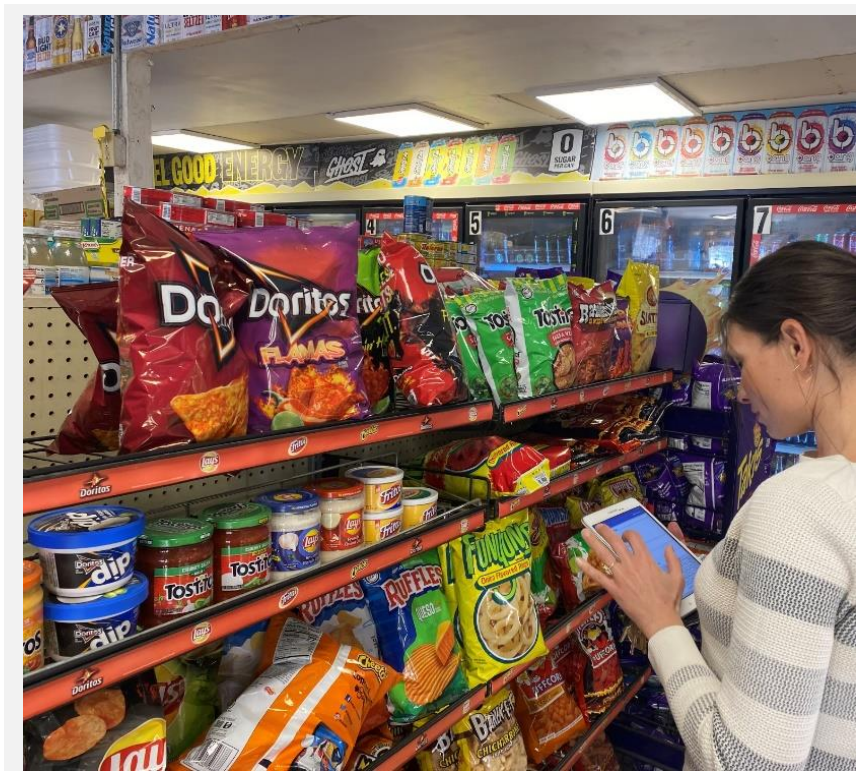
Products Collected

Corn masa is a dough which can be made directly into products such as tortillas or dried into CMF. Approximately 50% of corn masa products are made directly from the dough and 50% from flour reconstituted into dough.¹⁴ Retail bags of CMF (those sold in a grocery store as CMF) were the primary focus of this study as they are the main corn masa product known to be fortified with folic acid. A product entry was recorded for each CMF type in all stores visited, including brand, package size, serving size, and fortification levels as applicable. Examples of CMF types are found in Figure 3.

In addition to retail bags of CMF, other corn masa products collected include:

- Corn tortillas
- Tostadas (fried/baked tortillas)
- Taco shells (fried tortillas)
- Tortilla chips (fried/baked tortilla pieces)

All products were checked for fortification status, but tortilla chip entries were grouped by brand, rather than an individual entry for each product. The assumption was made that if a mass-produced product was not fortified in one location, it was consistently not fortified at any site visited.



Data collection of corn masa products in a California store, Tulare County.

Figure 3. Examples of corn masa flour retail bags



While all CMF retail bags, corn tortillas, and tostadas found at the stores were recorded, products were de-duplicated during analysis to be able to identify unique products by brand, type, bag and serving size, and color.

Physical Testing of Products Fortified with Folic Acid

In addition to recording CMF and corn masa products in grocery stores, physical samples of products labeled containing folic acid were tested for their folate levels. Testing included all forms of folate, including both naturally occurring folate and man-made folic acid.

All retail bags of CMF labeled as containing folic acid as well as four CMF retail bags that did not have labels containing folic acid (for comparison) and two masa products (one tortilla and one tostada) were purchased, processed, and sent to an accredited REPCO lab for testing. REPCO lab is accredited under ISO 17025 and tested the samples using the QCM-009 Enrichment Water Soluble Vitamins by UPLC method.

Small-Scale Producer Interviews

To gain insight into small-scale tortilla production, phone interviews were conducted with food producers in both study counties that advertised selling traditional, authentic corn tortillas and corn masa products. Relevant businesses were found via online search engines using terms like "tortillería near me", "authentic Mexican tortillas", "corn tortilla factory", "tortilla de maíz", and "masa de maíz fresca", along with study location names. Businesses were selected if they served local Hispanic/Latino communities and emphasized using nixtamal (traditional corn masa dough). Phone calls were made during business hours to speak with employees about masa sourcing; production processes; brands, quantities, and fortification status of CMF used; as well as fortification awareness.

Results

A total of 90 stores were visited in Bexar County, Texas, and Tulare County, California. Table 1 shows the number of stores visited and those selling CMF and CMF labeled as fortified with folic acid. Table 2 describes the number of corn masa products collected in the two counties and their folic acid fortification status. In total, 1585 corn masa products were recorded. When considering brand, product description (e.g., masa for tamales), size in grams, count, color of corn, and flavor, there were 312 unique products collected.

Table 1. Stores Visited in Bexar County, TX and Tulare County, CA

Store Information			
	California	Texas	Total
Number of stores visited	60	30	90
Number of stores with CMF	52	24	76
Number of stores with fortified CMF	50	22	72

Retail Bags of Corn Masa Flour

Of the CMF retail bags collected, there were 45 unique flour bag types (Table 2). Less than half (46.7%) of the unique CMF retail bag types were found to have

Figure 4. Examples of folic acid symbol on CMF retail bags



labels listing folic acid as an ingredient. However, not all of them advertise that they contained folic acid, i.e., lack of folic acid symbol on the bag (Figure 4).

Table 3 presents the most frequently seen brands of CMF retail bags, their distribution by corn color, and their distribution by bag size. Table 4 presents the percentage of unique fortified corn masa flour retail bags by corn color and bag size. White corn CMF in bags 1000–1999g was the most frequently found to be fortified.

Surveyed brands of corn masa flour did not appear to fortify consistently across all products. Table 5 shows the percentage of unique retail bags of CMF that were labeled as fortified with folic acid. The brands included in the ‘All other’ category were Bob’s Red Mill, Goya, Juana, Just About Foods, King Arthur, Maizada, Mama Lycha, Quaker, and Valley Grain Products. None of these brands indicated whether they are fortified with folic acid. Some brands include both fortified and non-fortified products. None of the bags branded as CMF for making tamales were fortified. Figure 5 shows an example of Maseca products that are and are not fortified.

Table 2. Corn masa products recorded and folic acid fortification status

	CA	TX	Total	Unique products collected	Unique products with folic acid listed as an ingredient
Corn masa flour	175	235	410	45	21 (46.7%)
Tortillas	285	274	559	167	1 (0.6%)
Tostadas	140	132	272	77	1 (1.3%)
Taco shells	23	39	62	23	0 (0%)
Tortilla chips	147	113	260	-	-
Other	10	12	22	-	-

Other includes masa-based foods such as masa preparada and sopes.

Table 3. Retail bags of corn masa flour by color and size

Corn masa flour (CMF) information

CMF Brands	California	Texas	Total	
Number of stores with Maseca	52	22	74 (82%)	
Number of stores with El Mexicano	24	3	27 (30%)	
Number of stores with Tortimasa	14	10	24 (27%)	
Number of stores with Masa Brosa	8	15	23 (26%)	
Number of bags by color	California	Texas	Total	Unique bag types
White	191	125	316 (77%)	32
Yellow	24	18	42 (10%)	6
Blue	20	19	39 (10%)	4
Other	NA	13	13 (3%)	3
Number of bags by size	California	Texas	Total	Unique bag types
<1000g (2.2 lb)	58	58	116 (28%)	12
1000-1999g (2.2-4.4 lb)	140	90	230 (56%)	18
2000g or more (4.4 lb +)	37	27	64 (16%)	15



Table 5. Percentage of unique fortified corn masa flour retail bags by corn color and bag size

Percent fortified by CMF color			
	CA	TX	Total
White	50%	44%	47%
Yellow	40%	67%	50%
Blue	67%	50%	50%
Other	NA	33%	33%

Percent fortified by bag size			
	CA	TX	Total
<1000 g	38%	24%	42%
1000-1999 g	58%	53%	61%
2000+ g	40%	43%	40%

Table 4. Percentage of unique fortified corn masa flour retail bags by brand

	Unique products	Number of bags collected	% unique CMF types fortified
El Mexicano	8	56	75%
Great Value	1	2	100%
H-E-B	2	6	50%
Masa Brosa	5	51	40%
Maseca	13	222	46%
Minsa	2	2	100%
Omalli	2	4	100%
Torti Masa	2	25	100%
All other	10	42	0%

Figure 5. Examples of Maseca products that are fortified and those not fortified



Corn Masa Products – Tortillas

Tortillas were the most frequently recorded CMF product, with 559 entries (Table 2). Out of these, only one tortilla brand, Treba, had labels listing folic acid as an ingredient. Treba tortillas were only found at two of the 90 stores visited. The numbers of stores where tortillas were recorded along with the most frequently seen brands of tortillas are presented in Table 6.

Other Corn Masa Products

The numbers of stores where the remaining CMF products – tostadas, taco shells, and tortilla chips – were recorded, along with the frequency of distinct brands, are presented in Table 7. Since these remaining CMF products were not expected to be fortified, Table 7 shows the brands present at the stores visited, rather than an exhaustive list of every product found at every store. Due to the very high number of tortilla chip products available, they were only collected to distinct brand saturation. That is, data collectors were only asked to collect tortilla chip brands they had not yet made an entry for. As such, the collection of tortilla chips was not done in each store visited.

Tortillerías

Nineteen small-scale corn masa product manufacturers were contacted regarding their use of pre-made corn masa flour versus whole corn in their production process. Most producers reported making their own masa from corn, which they nixtamalize in house (Figure 6). Table 8 reports the distribution of producers by flour usage (nixtamal in-house vs. purchased CMF).

Table 6. Tortillas by store location and store brands

Tortillas			
	CA	TX	Total
Number of stores where tortillas were recorded	40	23	63
Number of distinct brands	21	21	38*
Number of individual products collected	285	274	559
Number of unique products collected	92	89	167
Number of fortified products	0	1	1
Number of stores brand was found in by state			
Five most frequently seen brands			
	CA	TX	Total
Banderita	3	7	10
Guerrero	29	16	45
HEB	0	4	4
La Rosa	16	0	16
Mission	10	18	28

*Due to overlap between California and Texas, totals may be less than the sum.

Table 7. Other corn masa products, including tostadas, taco shells, and tortilla chips

Tostadas			
	CA	TX	Total
Number where tostadas were recorded	31	18	49
Number of distinct brands	23	16	35
Total entries recorded	140	132	272
Unique entries recorded	40	40	77
Fortified products recorded	0	1	1
Taco shells			
	CA	TX	Total
Number where taco shells were recorded	5	11	16
Number of distinct brands	3	7	10
Total entries recorded	23	39	62
Unique entries recorded	10	20	23
Tortilla chips			
	CA	TX	Total
Number where tortilla chips were recorded	29	17	46
Number of distinct brands	26	29	55
Total entries recorded	147	113	260



Figure 6. Masa preparada



Table 8. Nixtamal and flour usage at tortillerías

Nixtamal vs flour usage - local tortillerías			
	CA	TX	Total
Number of stores called	8	11	19
Number using only nixtamal	4	8	12
Number using only purchased CMF	2	3	5
Number using both	2	0	2

Results from Physical Testing of Products Fortified with Folic Acid

All tested sampled bags of CMF that were labeled as containing folic acid were found to contain folic acid. However, measured concentrations were highly variable among the tested samples. The test REPCO uses to measure folate does not differentiate the different forms of folate. That is, it measures folate levels for both naturally occurring folate and folic acid. The US Department of Agriculture estimates that unfortified corn masa flour has approximately 0.029 mg of folate on average per 100g of flour.¹⁵ However, levels of naturally occurring folate in wheat flour can vary due to growing conditions, and similar variations are anticipated with corn masa flour.

All fortified bags that listed a production location, 11 of 14, were produced in Mexico. The standard there is higher than the US (0.2mg folic acid /100g flour vs 0.15mg folic acid/100g flour). It is possible that imported flours are produced to the requirements of the country of origin and are not calibrated to US standards.



Discussion

The findings of this market assessment are consistent with previous assessments of folic acid fortified corn masa flour and corn masa products.^{11,13} The majority (86.3%) of unique corn masa flour and corn masa products collected did not list folic acid as an ingredient. Although nearly half of unique CMF retail bags (46.7%) were labeled as containing folic acid, these bags are a very small share (less than 10%) of the total masa market.¹⁴ Over 90% of the total masa market volume is tortillas and other corn masa products. Only one tortilla and one tostada found in this assessment were labeled as fortified with folic acid. These findings suggest that most people buying corn masa products (e.g., tortillas, tostadas, tortilla chips) are not currently receiving the intended benefit from voluntary folic acid fortification. There are reports that Guerrero and Mission, both subsidiaries of Gruma Corporation, are planning on transitioning into fortifying their corn tortillas (Figure 7). As these two tortilla brands are the first and second most frequently found in this assessment, this move has the potential to impact public health.

Figure 7. Shelves of Unfortified Tortillas



Notably, 63% (12/19) of small-scale masa product manufacturers interviewed make their own corn masa. Depending on the equipment these manufacturers own/use, fortifying their products may be difficult and this segment of the masa market may not be entirely fortifiable. If all CMF produced in the US was fortified with folic acid, any producers using CMF rather than making their own masa would then be selling fortified products.

An important limitation of this study was that it examined products by type, meaning it is not possible to determine from these data the proportion of corn masa in the study area that is fortified by volume. Additionally, since food supply chains vary regionally, these findings may not be generalizable to the entire US. This study did not examine consumer behavior on any level.

California is pursuing legislation to mandate folic acid fortification of corn masa flour and corn masa products. If this initiative is successful, some manufacturers may decide to fortify products, even ones not meant for the California market. Groups in Tennessee and Alabama are also considering pursuing mandatory fortification legislation. Industry can also increase the availability of fortified products by choosing to voluntarily fortify.

These steps from government and industry have the potential to increase the availability of folic acid fortified corn masa products in the US.

Conclusion

Findings from this assessment indicate only about half of CMF retail bags and very few other corn masa products in the study area are fortified with folic acid. Hence, it is largely only individuals buying CMF for cooking at home that currently benefit from voluntary folic acid fortification. Given that CMF retail bags are less than 7% of the total masa market, fortification of highly consumed, highly available products such as tortillas needs to be expanded to maximize public health benefits. Concerted efforts among manufacturers, health leaders, and governmental entities are needed to ensure the availability of fortified corn masa products and reduce the disproportionate burden of neural tube defects experienced by the US Hispanic community.

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Annex A: Epi Info electronic data collection forms

Store Information Form

Data Collection/Retail Assessment

Name of data collector: Date of visit: Time of Visit:

STORE INFORMATION

Store Name:

Address:

COORDINATES

☐ Click here to get coordinates

Longitude: Latitude:

Type of store:

Secondary store type (if applicable):

Additional comments:

ONLY COMPLETE THIS SECTION IF STORE TYPE IS GROCERY WITH RESTAURANT

Do you serve corn tortillas? ☐ Yes ☐ No

If no - do you serve any corn masa-based foods? ☐ Yes ☐ No

Do you make or buy your corn tortillas? ☐ Make ☐ Buy

Do you import any masa products from Mexico? ☐ Yes ☐ No

Do you know what food fortification is? ☐ Yes ☐ No

If yes, please describe:

Do you know what folic acid is? ☐ Yes ☐ No

Do you know if your CMF/tortillas are fortified with folic acid? ☐ Yes - fortified ☐ No - not fortified ☐ Not sure

Grocery with restaurant comments:

Product Collection Form

PRODUCT INFORMATION

Product type:

Brands:

Description of product:

Size of product (in grams): Serving size (in grams): ☐ Product not fortified with folic acid ☐ Folic acid information already collected

Is the product mass produced? Is there a nutrition label?

mcg DFE folate in 1 serving: mcg folic acid in 1 serving:

% of daily value in 1 serving: Is folic acid advertised or described anywhere on the package (i.e. logo, text)

Where is the product located in the store? ☐ Near the front ☐ In the middle ☐ Near the back

If the product is located on a shelf, where on the shelf is it? ☐ Above eye level ☐ At eye level ☐ Below eye level ☐ Product not located on a shelf

Additional notes:

☐ Image of front taken ☐ Image of back taken

Image of front Image of back

☐ Image Nutrition label taken ☐ Image flour/tortilla bag taken

Image of nutrition label Picture of flour or tortilla bag

