

# *Flour Fortification in Latin America*

Latin America District  
of the International Association  
of Operative Millers

November 20, 2011



**Flour Fortification Initiative**  
A Public-Private-Civic Investment in Each Nation

**Presented by**  
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# Agenda

- What is the Flour Fortification Initiative (FFI)?
- Why Fortify?
- Folic acid success
- Latin America status
- Current guidelines
- Recommendations



*Flour sack from Mexico recently added to Mühlenchemie Gallery of Flour Sacks.*





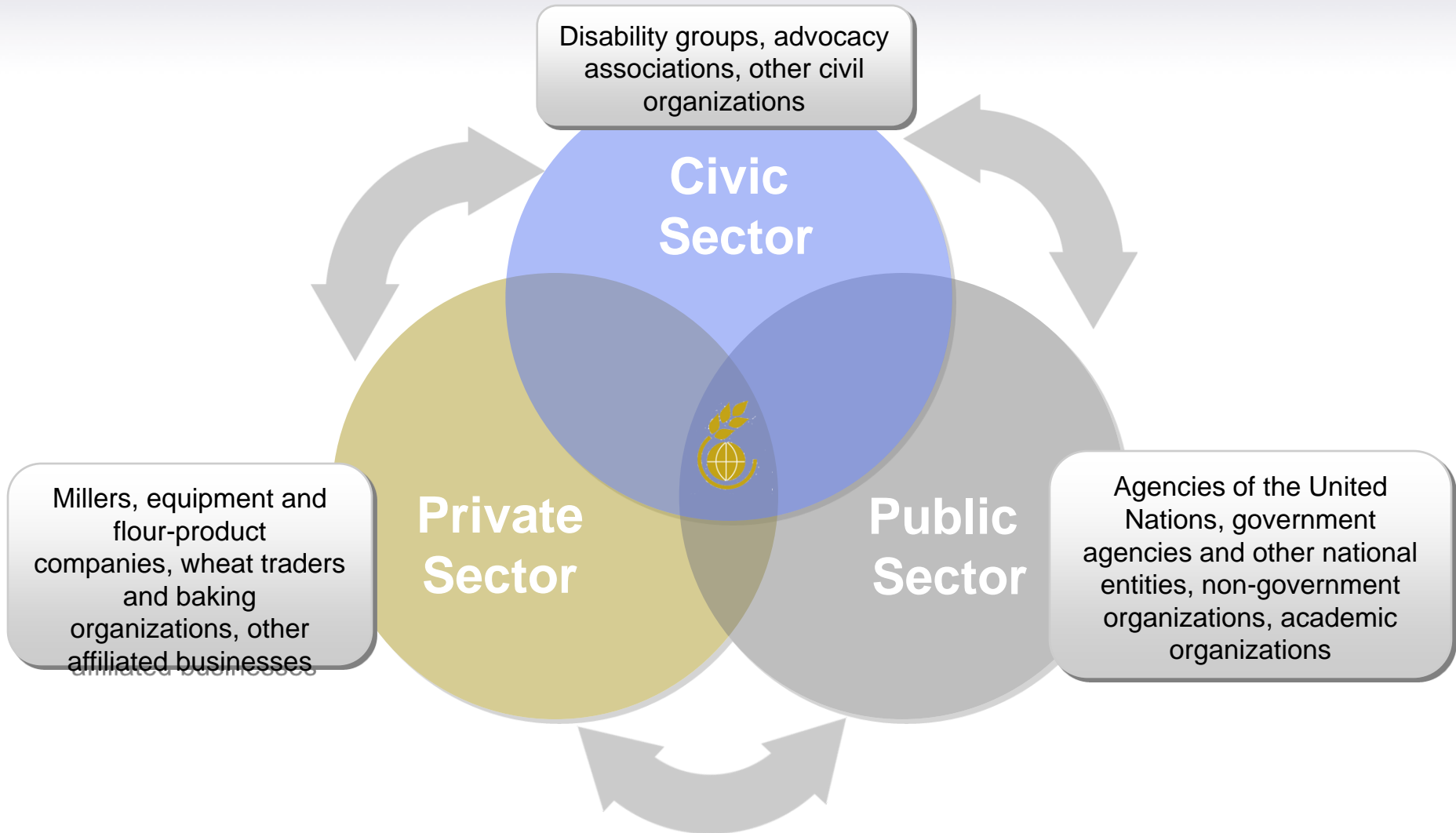
# What is FFI?

FFI is network of partners working together to make flour fortification standard milling practice so that people worldwide are smarter, stronger and healthier.

[www.FFInetwork.org](http://www.FFInetwork.org)



# FFI Network of Partners



# Why Fortify?



Iron deficiency is the leading cause of anemia which:

- Reduces work capacity
- Impairs a child's physical and intellectual development
- Contributes to 20% of all maternal deaths



# Estimated worldwide prevalence of iron deficiency in non pregnant women

	WHO	Estimated		
	Data from McClean <i>et. al</i> 2007	% IDA	%ID without anemia	Total ID
	% anemia			
Africa	44	22	22	44
Asia	33	17	17	34
Europe	15	14	14	28
Latin America	24	12	12	24
North America	8	7	7	14

Assuming: 50% anemia is IDA in Africa, Asia, and Latin America. 90% is IDA in Europe and US. Equal prevalence of IDA and ID without anemia.



# Why Fortify?

- Enough folic acid at the right time prevents 50% to 70% of neural tube birth defects.



***Spina bifida is malformation of the baby's spine. It causes permanent disability.***

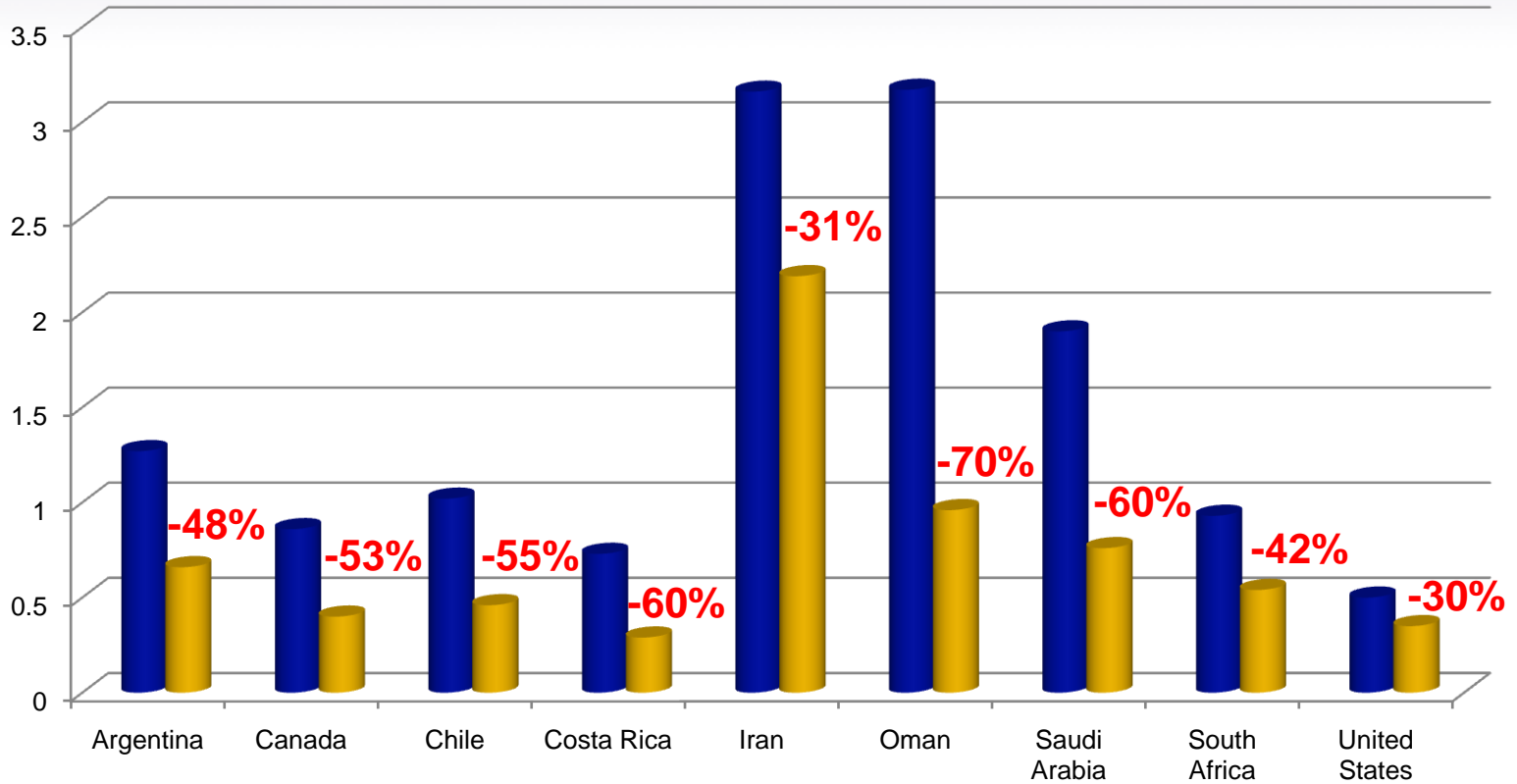


***Anencephaly is malformation of the baby's brain. It is always fatal.***



# Folic Acid Success

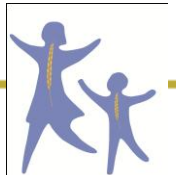
Neural tube birth defects per 1,000 births



■ Before fortification ■ After fortification

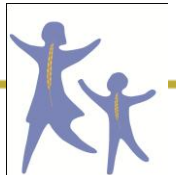
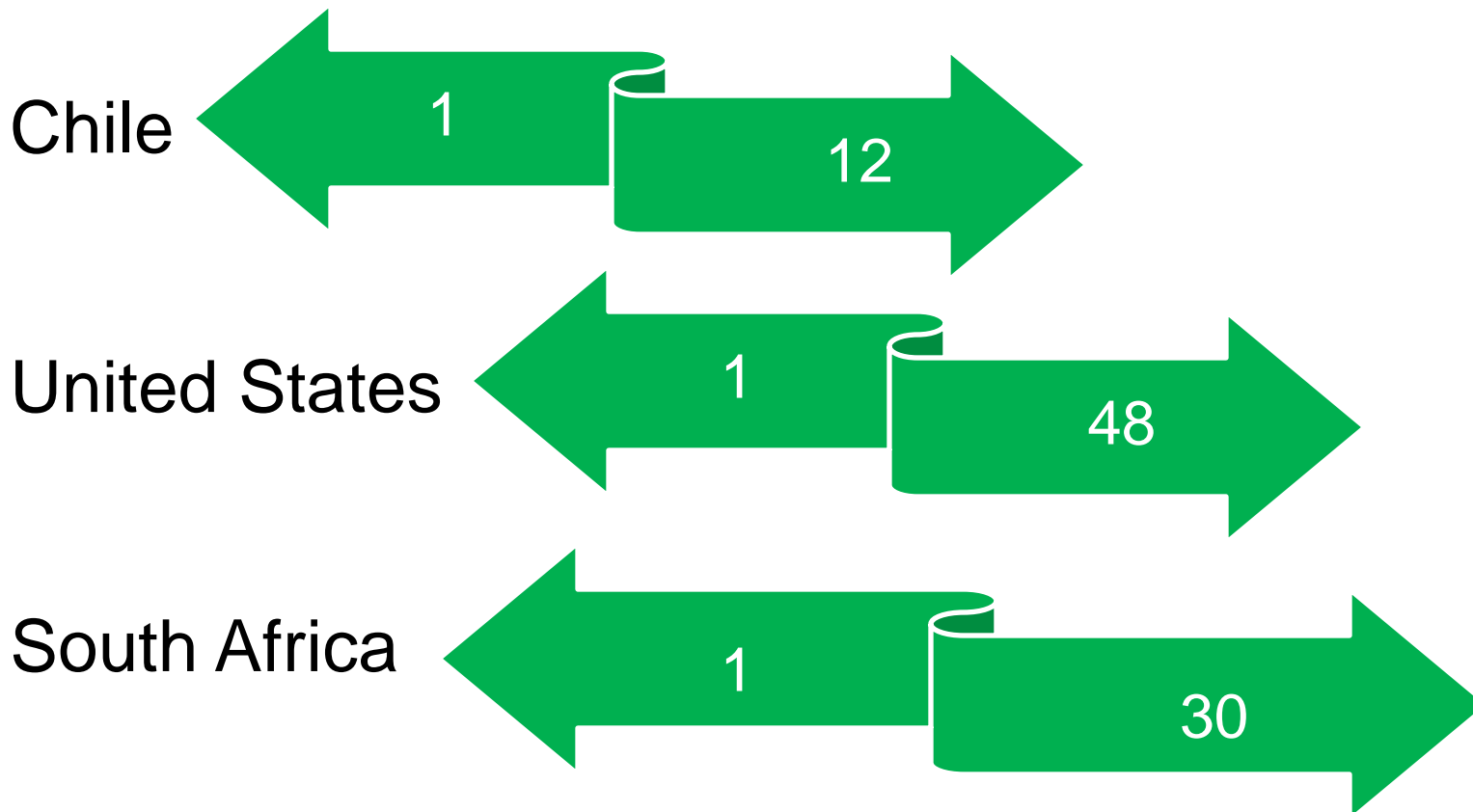


All rates are for spina bifida except Iran and Saudi Arabia which are for all neural tube defects  
All data from published sources.



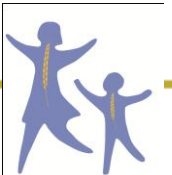
# Folic Acid Success

## *Cost:Benefit Ratio for Preventing Spina Bifida*



# Folic Acid Success

- 22,000 neural tube birth defects are prevented annually due to flour fortification worldwide
- That's 60 healthy babies a day

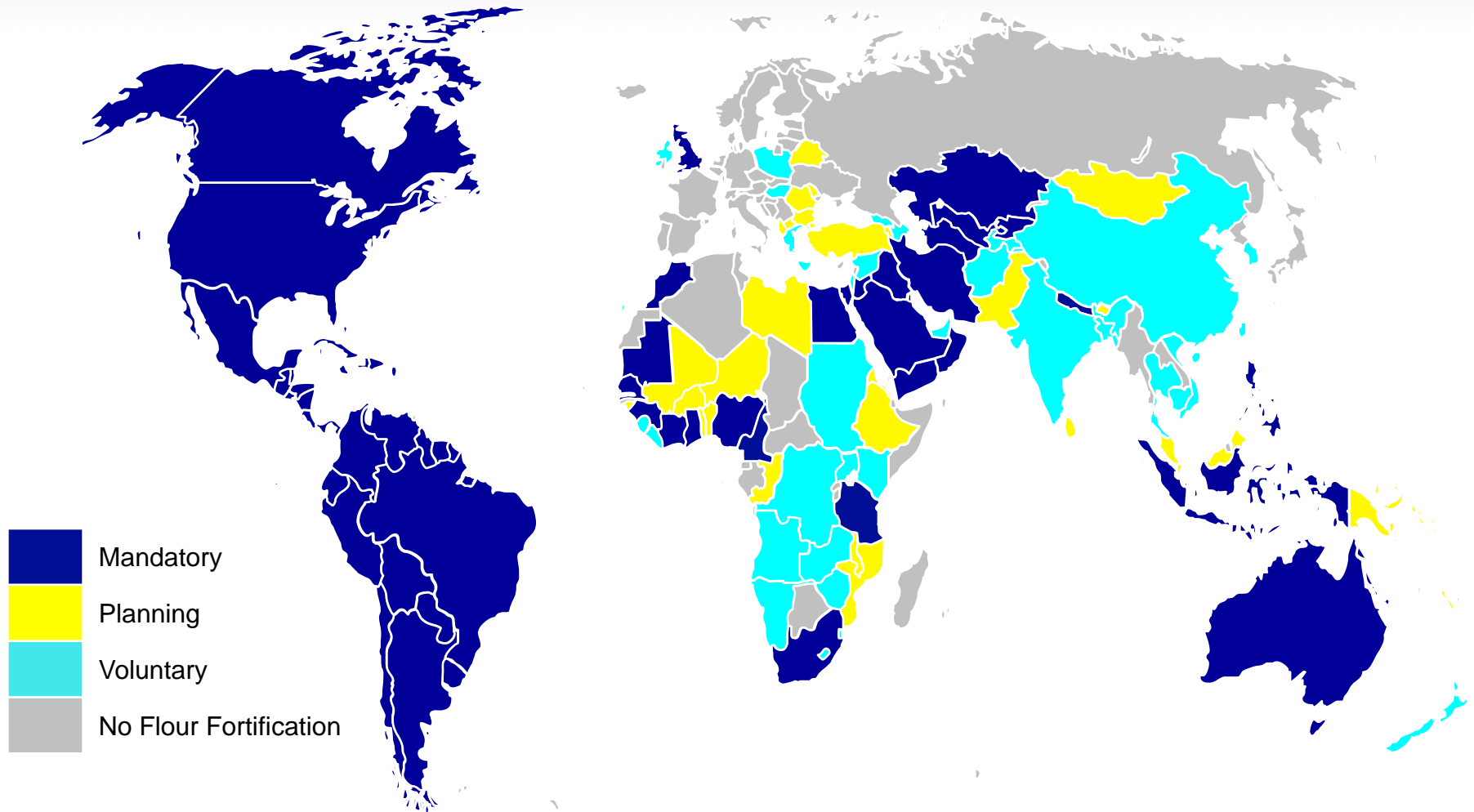


**“Thanks for fortifying my mom’s flour!”**



# Wheat Flour Fortification Status

October 2011: Fortifying with at least iron and/or folic acid



# Latin America Overview

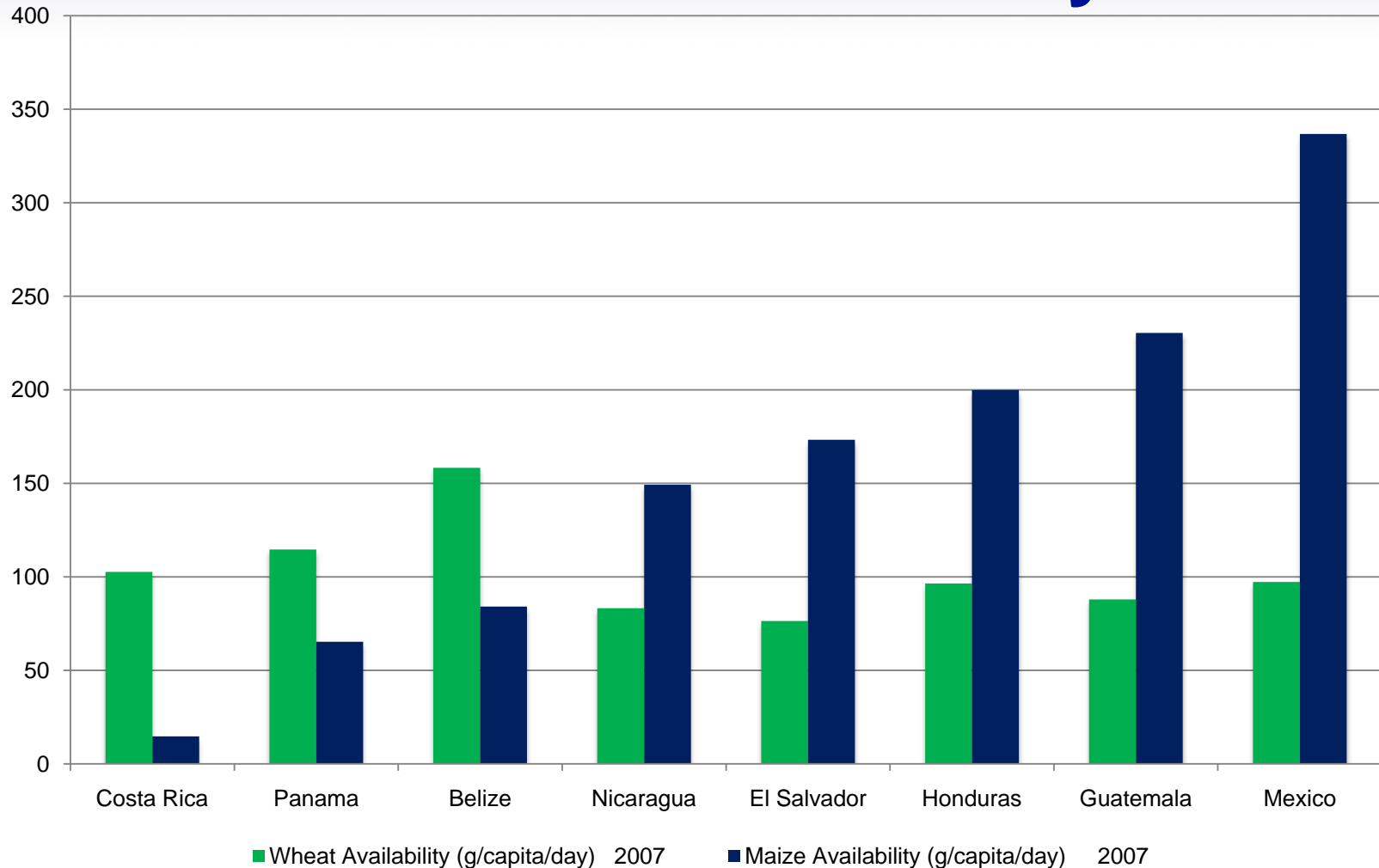
- Wheat flour fortification is mandatory in every country except French Guiana.
- Maize flour fortification is mandatory in Mexico, Brazil, Venezuela and most countries in Central America
- Venezuela fortifies with iron but not folic acid
- Mexico is only country that fortifies with zinc



*Bolivia photo by Alexandra Dionyssia Huttinger*



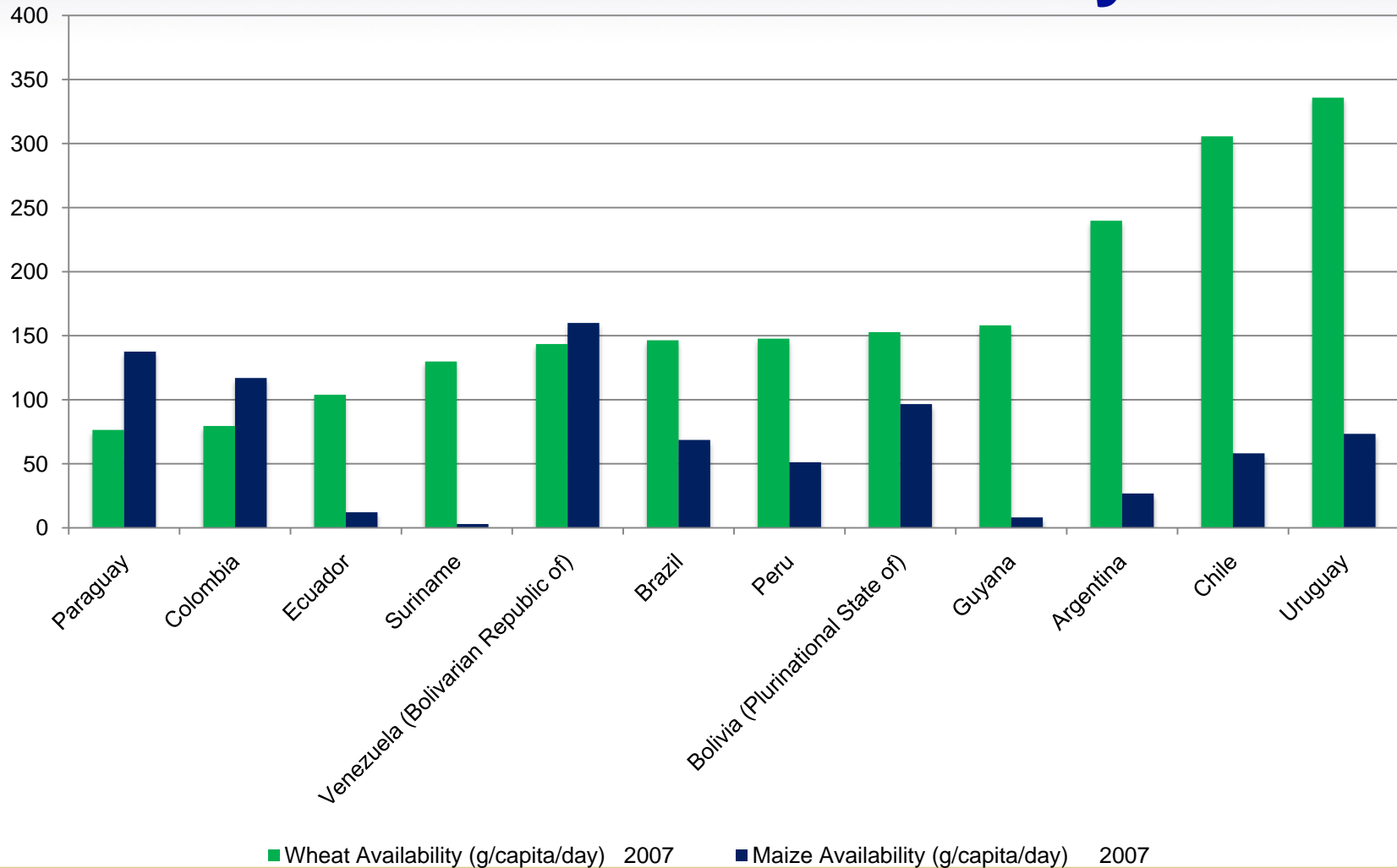
# Mexico and Central America Wheat and Maize Availability



Source: Food and Agriculture Organization

# South America

## Wheat and Maize Availability



Source: Food and Agriculture Organization

# Current Guidelines



**Organización  
Mundial de la Salud**

## **Recomendaciones sobre la fortificación de las harinas de trigo y de maíz**

### **Informe de reunión: Declaración de consenso provisional**

#### **FINALIDAD**

La presente declaración se basa en las evaluaciones científicas preparadas para un taller técnico de la *Flour Fortification Initiative* (FFI) celebrado en Stone Mountain, Georgia (EE.UU.) en 2008, donde se reunieron diversas organizaciones activamente comprometidas con la prevención y el control de las carencias de vitaminas y minerales así como otras partes interesadas y debatieron una serie de recomendaciones prácticas y concretas para orientar los esfuerzos de enriquecimiento o fortificación de las harinas que los sectores público, privado y cívico-social actualmente están implementando en diversos países. Esta

#### **EL SEGUNDO TALLER TÉCNICO DE LA FFI SOBRE LA FORTIFICACIÓN DE LA HARINA DE TRIGO**

Cerca de 100 importantes científicos en el área de la nutrición, farmacéutica y de los cereales, así como harineros y expertos de los sectores público y privado de todo el mundo, se reunieron del 30 de marzo al 3 de abril de 2008 en Stone Mountain, Georgia (EE.UU.) para asesorar a los países que estén considerando la fortificación de las harinas de trigo y/o maíz a escala nacional. Este *Second Technical Workshop on Wheat Flour Fortification: Practical Recommendations for National Application* se hizo en seguimiento del primer taller técnico de la FFI



# Current Guidelines

Nutrient	Flour extraction	Fortificant	Level of nutrient to be added (parts per million) By per capita wheat flour intake (g/day)			
			<75	75-149	150-300	>300
Iron (Fe)	Low	NaFeEDTA	40	40	20	15
		Sulfa/Fumarate	60	60	30	20
		Electrolytic	NR	NR	60	40
	High	NaFeEDTA	40	40	20	15
Zinc (Zn)	Low	Zn oxide	95	55	40	30
	High	Zn oxide	100	100	80	70



# Current Guidelines

Nutrient	Flour extraction	Fortificant	Level of nutrient to be added (parts per million) by per capita wheat flour intake (g/day)			
			<75	75-149	150-300	>300
Folic Acid	Low/High	Folic Acid	5.0	2.6	1.3	1.0
Vitamin B <sub>12</sub>	Low/High	Cyanocobalamin	0.04	0.02	0.01	0.008
Vitamin A	Low/High	Vitamin A palmitate	5.9	3.0	1.5	1.0



# Recommendations

- Keep up the good work
- Compare your country standard with recent global guidelines
  - Is the recommended iron compound used?
  - Is enough folic acid used?
  - Should other nutrients be added?
  - Is maize flour fortified as well as wheat?



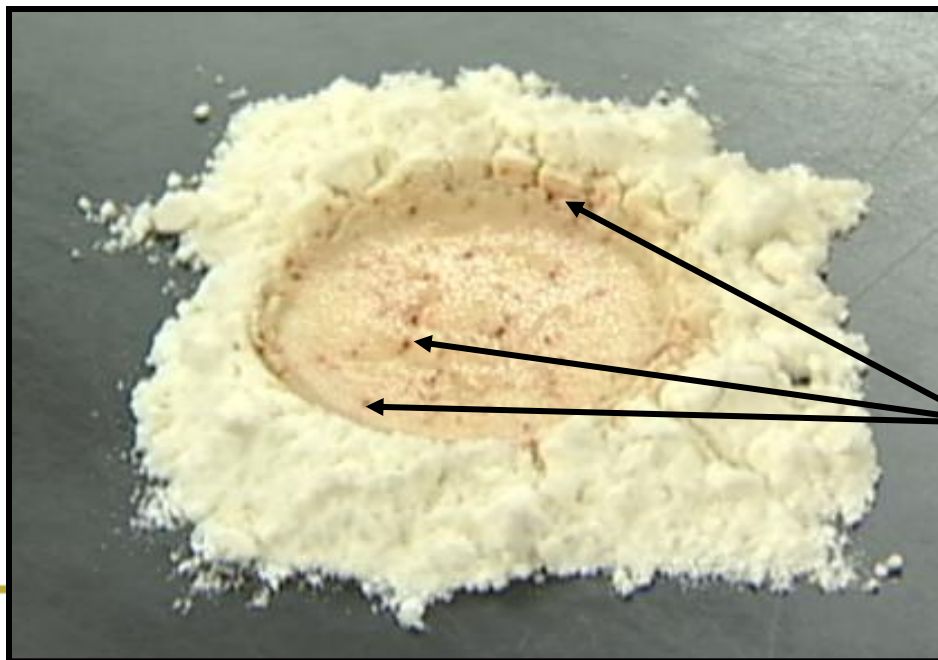
# Recommendations

- Advocate for revised standards if necessary
  - FFI will keep advocating and would be happy to collaborate with you in this effort if needed



# Recommendations

- Confirm reliability of internal quality process at your mill
  - Is iron spot test conducted several times a day?
  - Are new staff trained in fortification?
  - Is premix supply monitored for consistent use?



**Red spots in iron spot test confirm presence of iron**

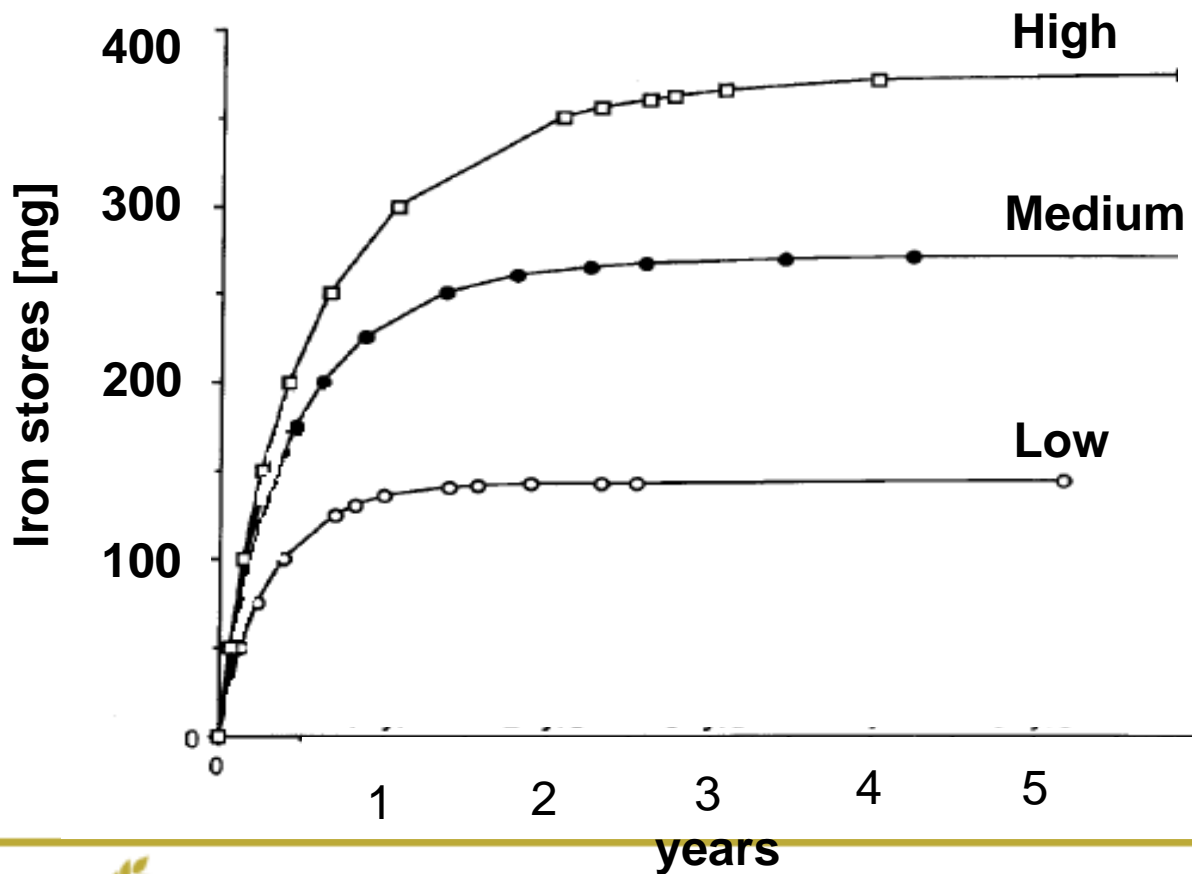


# Questions

Thank you for your  
attention



# Modeled increase in iron stores for women consuming diets with different amounts of bioavailable iron (Hallberg et al 1998)



Time needed by women with no iron stores to reach new equilibrium of iron stores after an increase in dietary bioavailable iron



# Impact of current flour fortification programs: Countries using ferrous sulfate

	Flour consumption per day	Iron ppm	Implementation	Additional Fe mg/d
Argentina	229	30	80	5.5
Chile	215	30	90	5.8
Cuba	76	45	70	2.4
Iran	354	30	40	4.2
Jordan	238	34	90	5.7
Palestine	216	25	60	3.2
Paraguay	22	40	80	0.8
Philippines	44	50	60	1.3
Turkmenistan	450	20	80	7.2
Uruguay	211	30	80	5.1



# Impact of current flour fortification programs: Countries using ferrous fumarate

	Flour consumption per day	Iron ppm	Implementation	Additional Fe mg/d
Bolivia	63	60	80	3.0
Costa Rica	88	60	80	4.2
Dominican Rep	58	55	90	2.9
El Salvador	58	55	80	2.6
Ghana	39	45	80	1.4
Guatemala	60	55	80	2.6
Honduras	58	55	70	2.2
Nicaragua	55	55	80	2.4



# Impact of current flour fortification programs: Countries using electrolytic iron

	Flour consumption per day	Iron ppm	Implementation	Additional Fe mg/d
Azerbaijan	440	40	20	3.2
Bahrain	200	60	80	9.6
Ivory Coast	29	60	90	1.6
Kazakhstan	278	40	30	3.3
Krygz Rep	380	40	20	3.0
Lesotho	75	35	80	2.1
Mongolia	202	40	50	4.0
Nigeria	36	40.7	80	1.2
South Africa	96	35	90	2.8
Tajikistan	302	28.9	20	2.4



# Flour fortification with iron

Country	Coverage (%)	Additional Intake (% EAR)	Serum Ferritin % < 12 µg/L	Anemia %
South Africa (w/m flours)	Rural 95	Women rur: 11	25 → 25	7.5→5.0
Venezuela (w/m flours)	Corn:88 Wheat:77	7-15 y.: 25	37 → 16	19 → 9, but then 17%

Modified from Dary, O. & col., Innocenti meeting, 2008



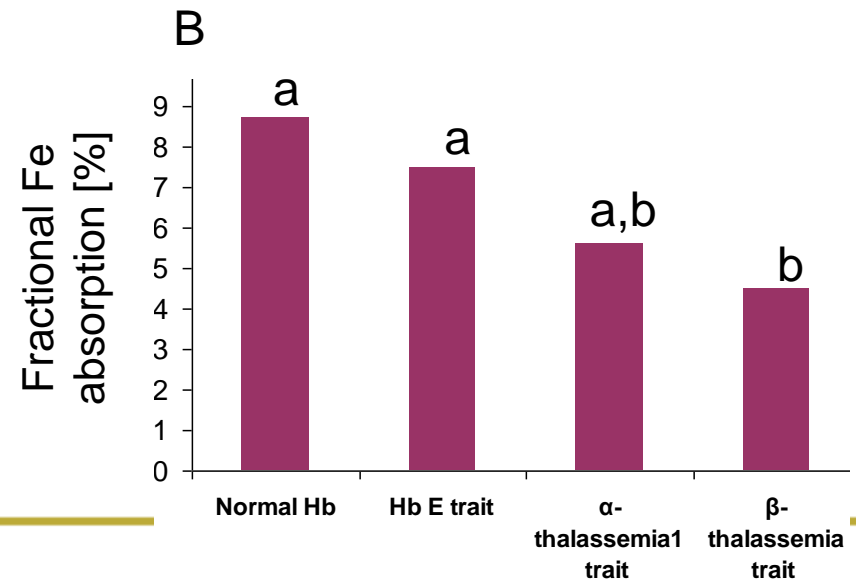
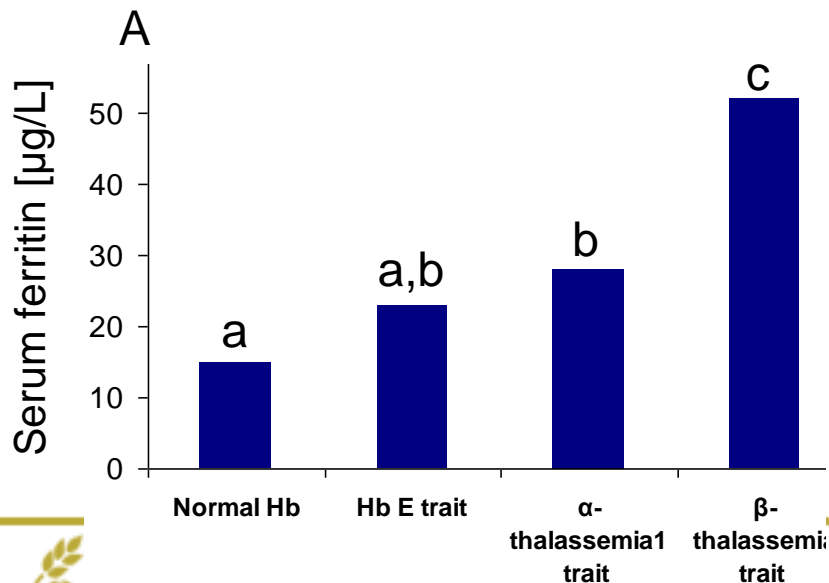
# Safety of mass fortification: genetic disorders

- ★ Systemic iron overload as a result of excessive absorption occurs in genetic disorders that affect the hepcidin / ferroportin system
- ★ HFE hemochromatosis is the commonest condition
- ★ 1 in 300 Caucasians are homozygous and therefore have the genotype that puts them at risk for iron overload
- ★ However penetrance is low; <1% express the **clinical phenotype**
- ★ Iron fortification in the USA has not accelerated the clinical manifestations of hemochromatosis
- ★ Heterozygotes who carry a single gene are unaffected



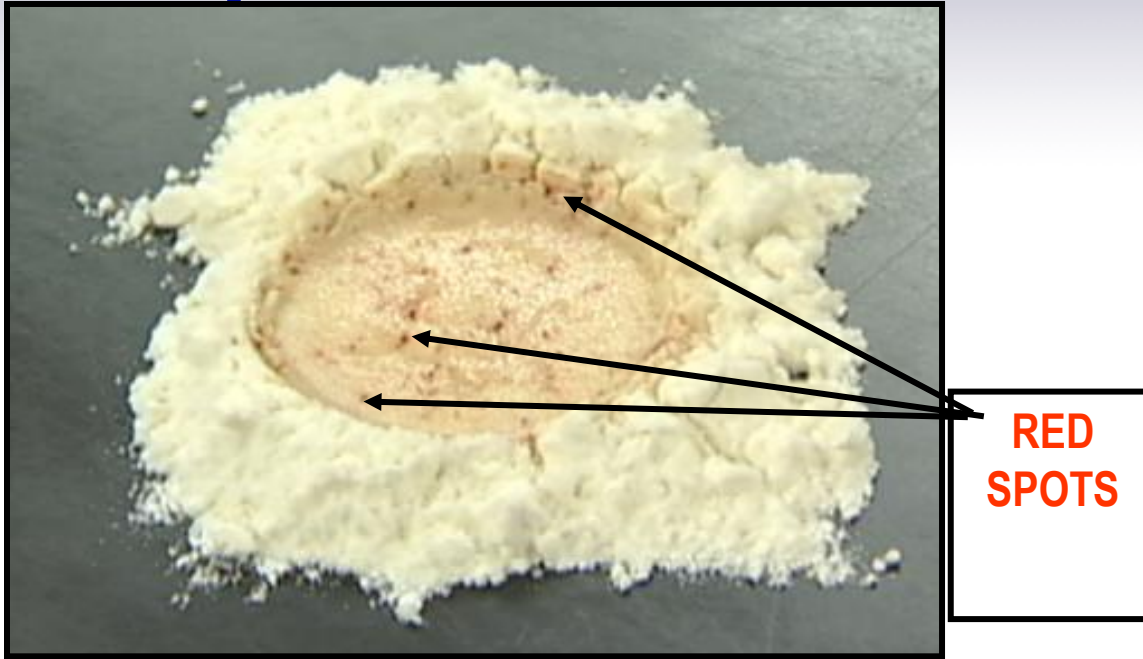
# Safety of mass fortification: genetic disorders

- ★ Patients with thalassemia suffer from iron overload because of both excessive absorption and life saving blood transfusions
- ★ Heterozygote carriers absorb a little more iron and have modestly increased iron stores; iron balance is restored once the increased store leads to hepcidin induced down regulation of absorption; they do not accumulate sufficient iron to cause organ damage
- ★ Geometric mean of serum ferritin (A) and uncorrected fractional absorption (B) in Thai women by hemoglobin (Hb) type (Zimmermann et. al, unpublished)

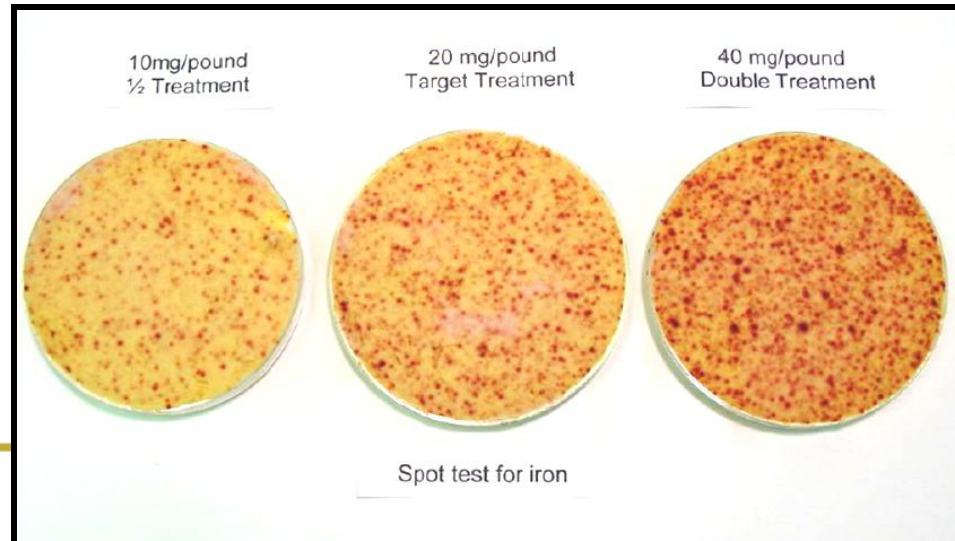


# Iron Spot Test

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# Record Keeping



- Premix Records: Check, record and maintain information on the delivery and usage of the premix.
- Flour Production Records: Collect and maintain information on how much fortified flour was produced.
- Premix Usage Reconciliation: Reconcile and record actual usage of premix versus target needs. The amount of premix used should be compared against the flour production records and recorded. This provides a simple way of determining if the correct amount of premix is being used.
- Quality Control Testing Records: Results of quality control tests performed in the mill and also those done outside must be carefully recorded and kept on file. These document the history and producer's supervision of the fortification process.



# Processing Losses

- Vitamin levels are lost during processing
- Vitamin            Bread                            Flat bread                            Noodles
- A                    0-20%                                    28%                                    -
- B1                   16-24%                                   -                                        42%
- B2                   8-10%                                   -                                        30-40%
- B3                   5-10%                                   -                                        39-50%
- Folic Acid        10-20%                                   -                                        20-30%
- Minerals           0-10%                                   0-10%                                10-20%

Source: Nutrient addition to foods; 1983 Bauernfeind & Lachance CRC Press

