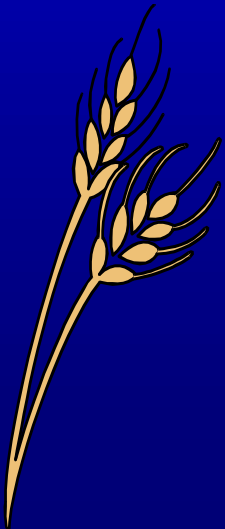


**Applying Best Practices
in Flour Fortification Technology
in the Region
*Challenges and Opportunities***

PETER RANUM

Consultant to ADB and Unicef



What is Flour Fortification?



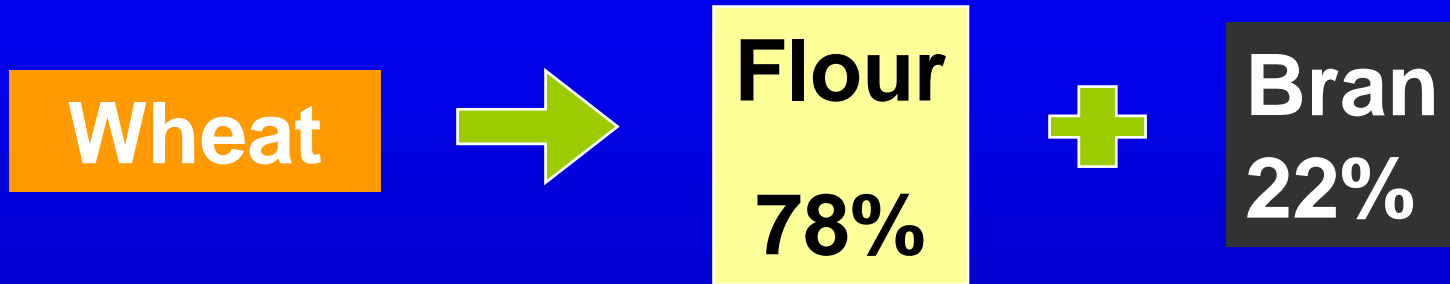
FORTIFICATION

- Addition of micronutrients (vitamins and minerals) to wheat flour at the mill,
- that may or may not be present in the cereal,
- for which there is a demonstrated need within the general population,
- to levels necessary to meet that need.

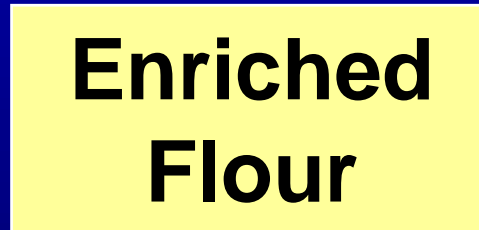
ENRICHMENT

- Adding BACK to wheat flour those micronutrients (vitamins and minerals) that removed from wheat by milling,
- for which there is a demonstrated need within the general population,
- to levels present in the whole wheat.

Milling wheat into white flour removes about two-thirds of the vitamins and mineral

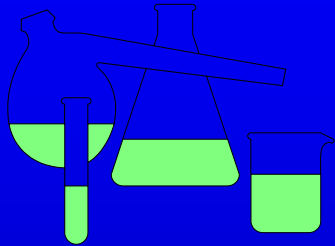


Enrichment of flour adds back the vitamins and minerals removed

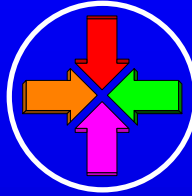


WHEAT FLOUR FORTIFICATION

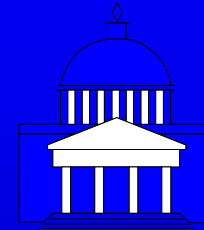
VITAMINS AND MINERALS
PRODUCED BY MODERN
CHEMICAL TECHNOLOGY



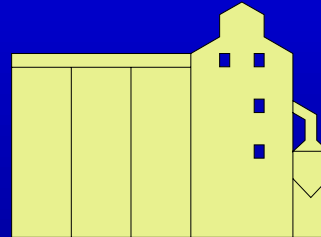
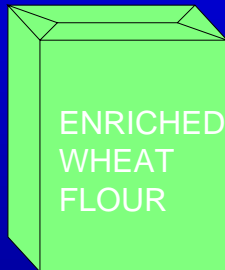
ARE BLENDED TO
MAKE A **PREMIX**



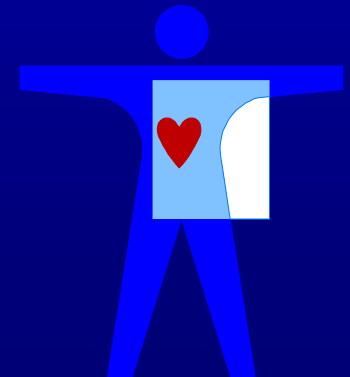
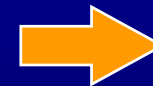
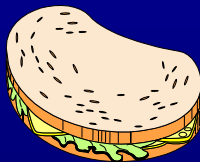
IN ACCORDANCE WITH
GOVERNMENT REGULATIONS



WHICH IS ADDED TO WHEAT FLOUR
AT THE MILL



THE FORTIFIED FLOUR IS EATEN AS BAKED PRODUCTS
MAKING FOR A HEALTHIER POPULATION

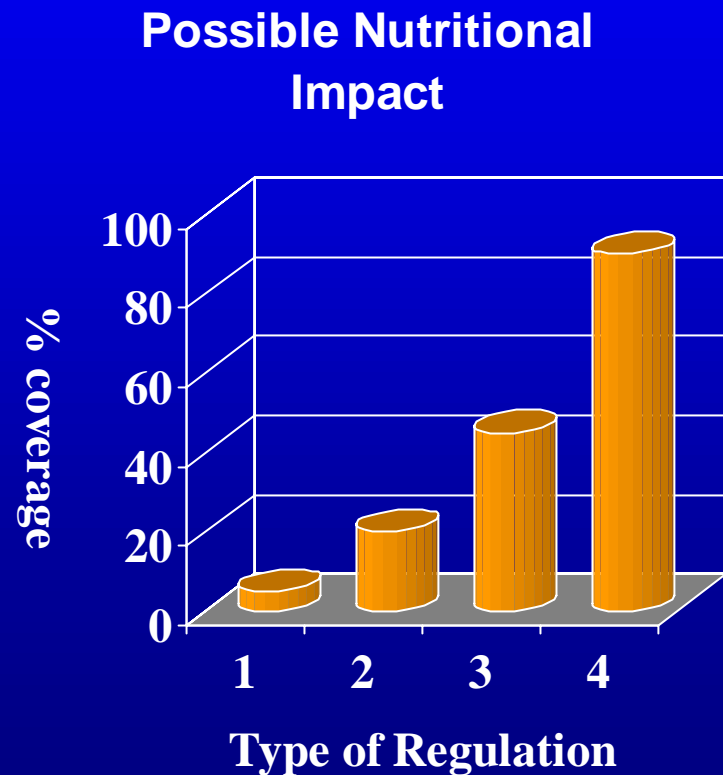


A Flour Fortification Program

- **Is a public health measure to benefit all people**
- **Is preventive, not curative**
- **Is very inexpensive compared to other intervention programs**
- **Is ultimately paid for by the people who benefit.**

Types of Fortification Programs or Regulations

1. Allowed
2. Defined, voluntary but required on government purchased flour
3. Defined, voluntary, regionally mandated
4. General mandatory



Why is Fortification best done at the mill?

- Not practical to add at down stream processors (e.g. bakeries), Too small and too numerous.
- Well established technology
- Affords better control over quality and compliance.
- Easier to regulate and monitor.

The standard practice in most countries is to fortify flour at the mill, not bakeries.

How Effective is Cereal Fortification in Improving Micronutrient Health?

Three years after folic acid was included in the United States cereal enrichment standards, folate serum levels doubled in the U.S. population and neural tube defects dropped 15%.

**What other countries
fortify wheat flour?**



Countries with Flour Fortification Programs

- United States and Canada - since 1941
- United Kingdom
- Chile, Peru, Bolivia, Paraguay, Equator
- Venezuela
- All Central America
- Saudi Arabia
- Oman, Bahrain (new)
- Nigeria
- Indonesia (new)
- Mexico (new)
- Philippines (new)

Flour Fortification in the United States and Canada

Nutrient	Standard (ppm min.)	Added (ppm)	Natural (ppm)	Total (ppm)
Thiamin	6.4	5.8	2	7.8*
Riboflavin	4.0	4.0	0.3	4.3*
Niacin	53	46	12	58
Folic Acid	1.5	1.5	0.4	1.9*
Iron	44	38	10	48

* There will be a 5% to 20% loss of these vitamins in the fortified flour during milling and storage.

**What is the flour
fortification program
proposed for this region?**



Proposed Flour Fortification

- Calculations done by Dr. Mussa Aidjanov, Kazakhstan Institute of Nutrition and final levels endorsed by Dr. Nevin Scrimshaw, International Nutrition Foundation.
- Based on making up **shortfall** between:
 1. mean dietary intakes in region of six important micronutrients typically added to flour and the
 2. newest recommended dietary intakes (RDI)
 3. in an average wheat flour consumption of 260 grams/person/day.

1. 1996 Nation-wide Kazakhstan Nutrition survey.
2. Food and Nutrition Board , Institute of Medicine, National Academy of Sciences Press, 2001.
3. Estimate of daily flour consumption target that can be ultimately fortified.

Proposed Flour Fortification

- Ideally, the proposed standards will be the same for all the countries in the region to promote uniformity, trade and reduce cost.
- The proposed standards can never be exact because of uncertainties and variation in dietary intakes and flour consumption in the different countries
- But they represent the best attempt at solving nutritional deficiencies in the region for these particular micronutrients.

Proposed Flour Fortification for the Central Asian Republics

Nutrient	Standard (ppm minimum)	Added (ppm)
Thiamin	3.2	2
Riboflavin	2.8	3
Niacin	20	10
Folic Acid	1.3	1.5
Iron	36	30
Zinc	25	22

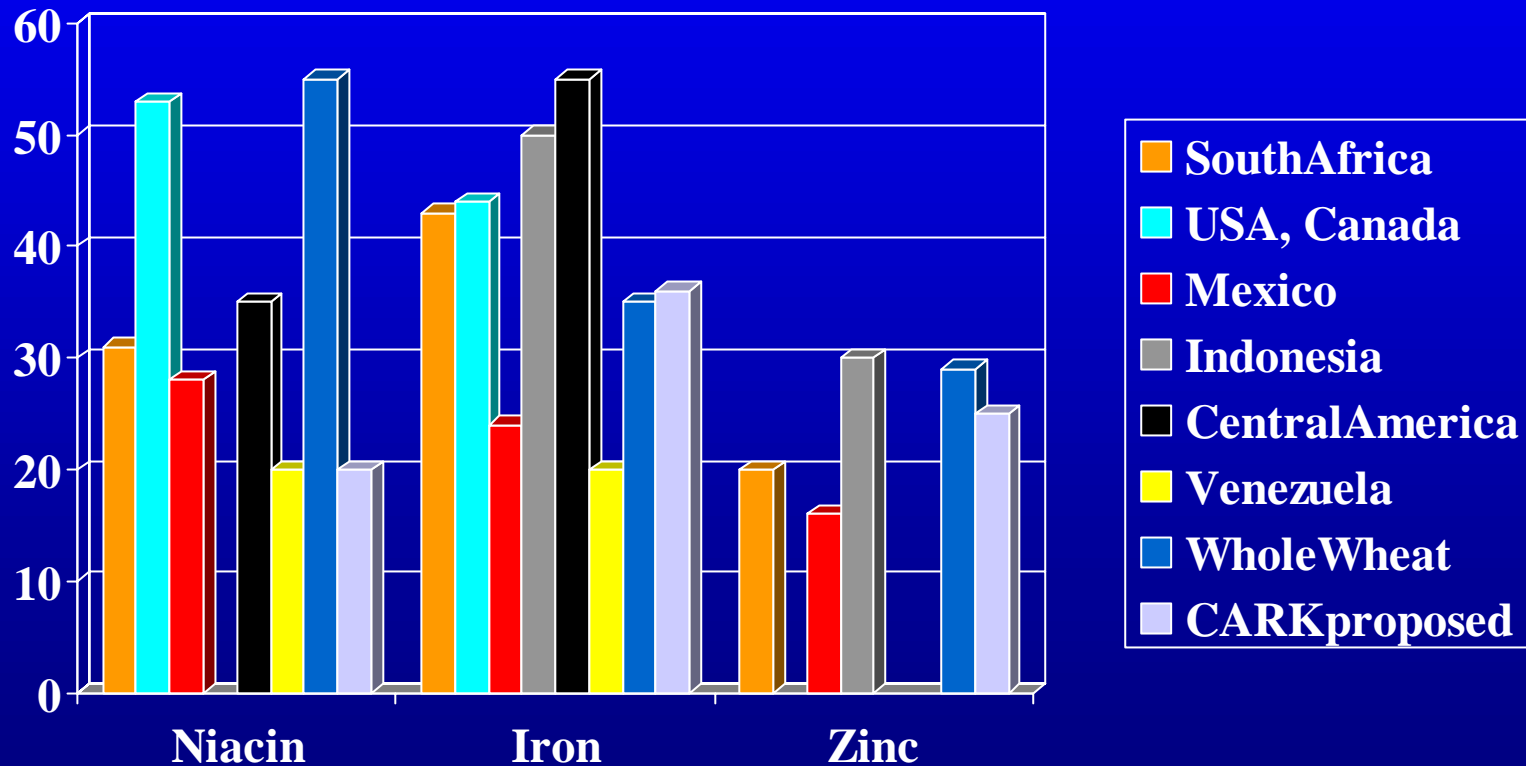
Why were these particular vitamins and minerals chosen?

- It is well established that they can be safely added to wheat flour without damaging the color, taste or quality of the flour, bread or baked products.
- They are all naturally present in wheat.
- They are inexpensive.
- They are known to be widely deficient in the diets of the people in this region.

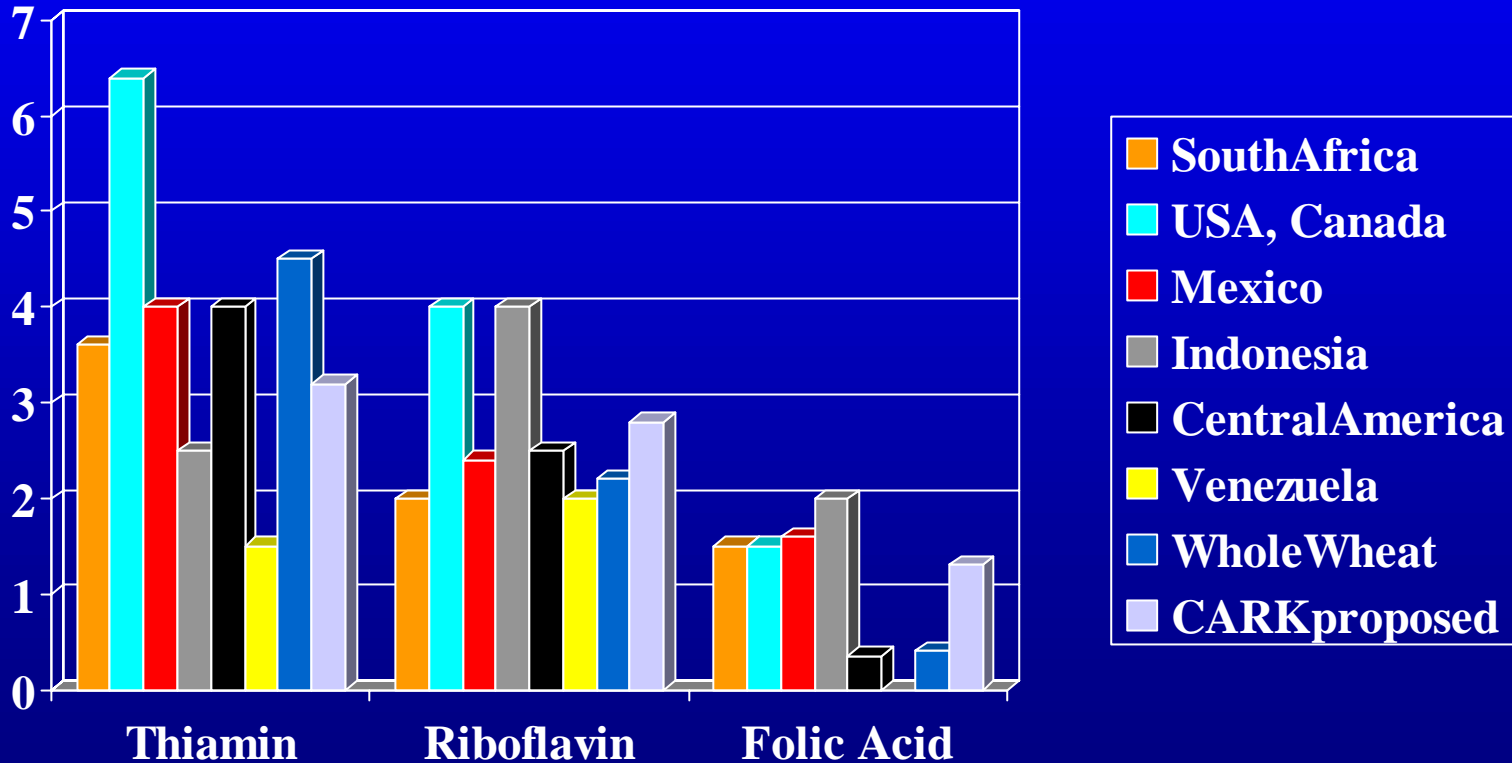
How does the proposed flour fortification compare to that practiced in other countries and to the levels in wheat ?



Comparison of minimum flour fortification standards for niacin, iron and zinc in different countries



Comparison of flour fortification standards for three B vitamins in different countries



- **The types and levels of vitamins and minerals to be added in the proposed program are similar to and no higher than those used in other countries.**
- **Folic acid level is higher than that in wheat, niacin is lower and the other four micronutrients are nearly the same as that in whole wheat.**



What This Flour Fortification Cost ?



Costs

- Over 90% of the cost of flour fortification is in the vitamin/mineral PREMIX. The levels to add determine the composition and, thus, the cost of the premix.
- Other continuing costs include labor and quality control.
- Initial start-up cost include equipment and new labeling.

PREMIX

- Initially designed to be added at rate of 200 grams per metric ton of flour, which can be easily handled in most mills. Called type K4 premix.
- Estimated cost of K4 in Europe is \$3.50/kg giving flour treatment cost of \$0.70 per MT.
- There will be other shipping and handling costs, but final cost will be below \$1.00/MT

Proposed Steps

- Establish enabling regulations for each country.
- Pilot project in a couple Kazakhstan mills to demonstrate technology.
- Select mills to participate in project.
- Workshop for millers.
- Obtain premix and equipment.
- Feeder installation in mills.



Target number of mills to start fortifying flour in each country

	Number of Mills to equip
Kazakhstan	15
Kyrgyz	8
Uzbekistan	20
Tajikistan	5
Mongolia	2
Azerbaijan	4

Goals for four CARK countries

- Total 48 mills set up to fortify flour
- of mean milling capacity of 250 MT of wheat per day operating 300 days/year.
- fortifying 150 MT flour per day each
- or total of 7200 MT flour per day
- would supply 203 grams of fortified flour per person (total population 35.3 million)

Safety Issues

- Over treatment
 - Iron spot tests
 - Riboflavin color
- Excessive intake
 - New Tolerable Upper Intake Levels (UL)
 - UL 45 mg/day for Fe or 1250 grams of flour (4600 kcal)
 - Highest normal flour consumption is 500 g/day

Criteria for Mill Selection

- Milling capacity of 200 MT/day or greater.
- Mill operating on regular basis.
- Management of mill is willing to participate in project.
- Mill producing bread or bakery flour.

What mills can expect to receive by participation

- Premix for duration of project.
- Ingredient feeders worth about \$8000 each.
- Help with associated equipment, engineering and design costs.
- Technical assistance and training on installation, calibration, maintenance, labeling, marketing and quality control.
- General consumer promotion of fortified flour.

Other Issues

- Maximum storage time of fortified flour with K4 premix: 3 months.
- Home-use flour with longer shelf life requirement will require 60 ppm iron as elemental iron (K6 premix).
- No flour storage or packaging changes will be required.



Wheat Flour Fortification is

- **Effective**
- **Affordable**
- **Achievable**