Fortified foods

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Conference on processed foods for nutrition security
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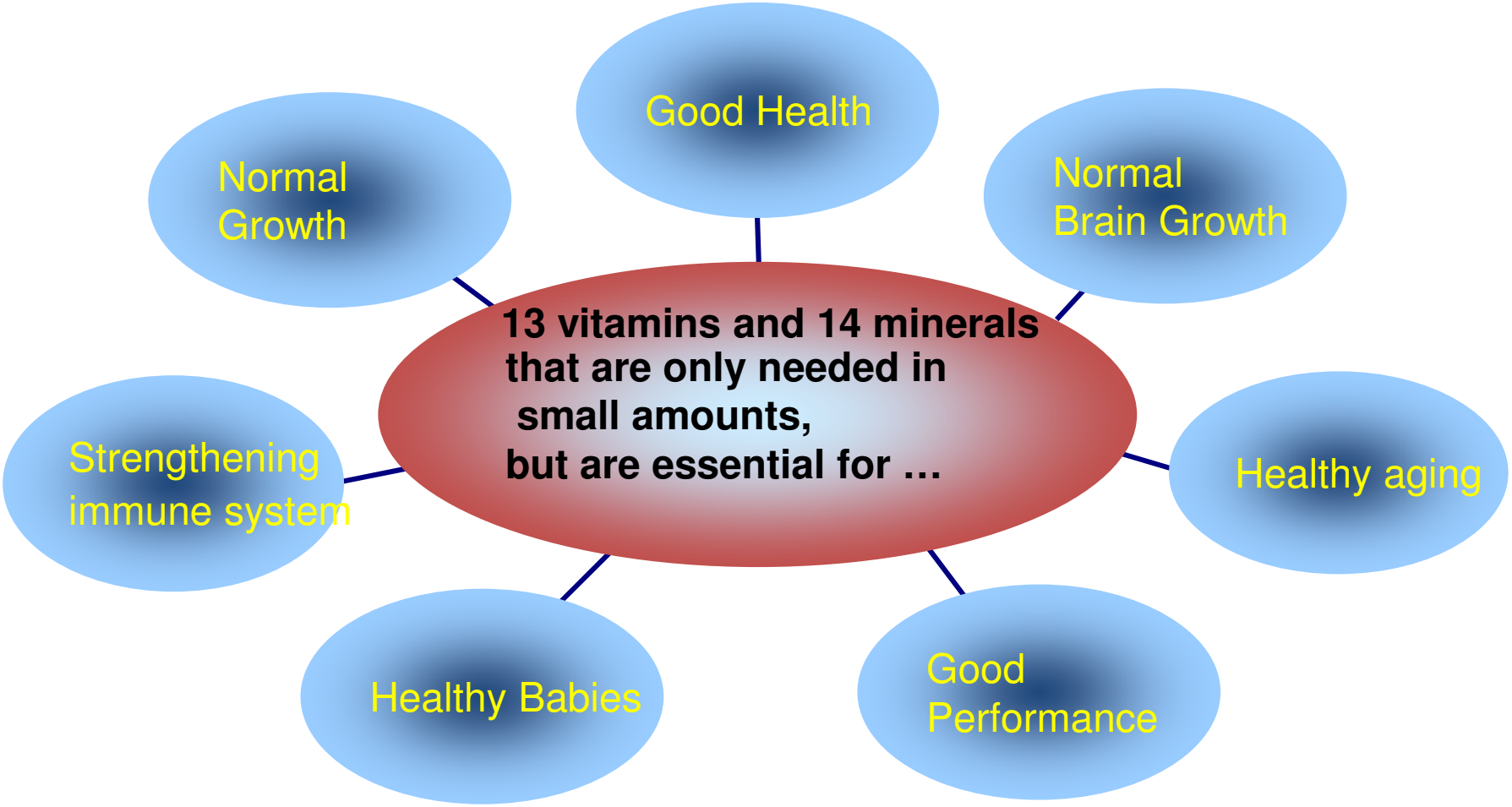
OUTLINE

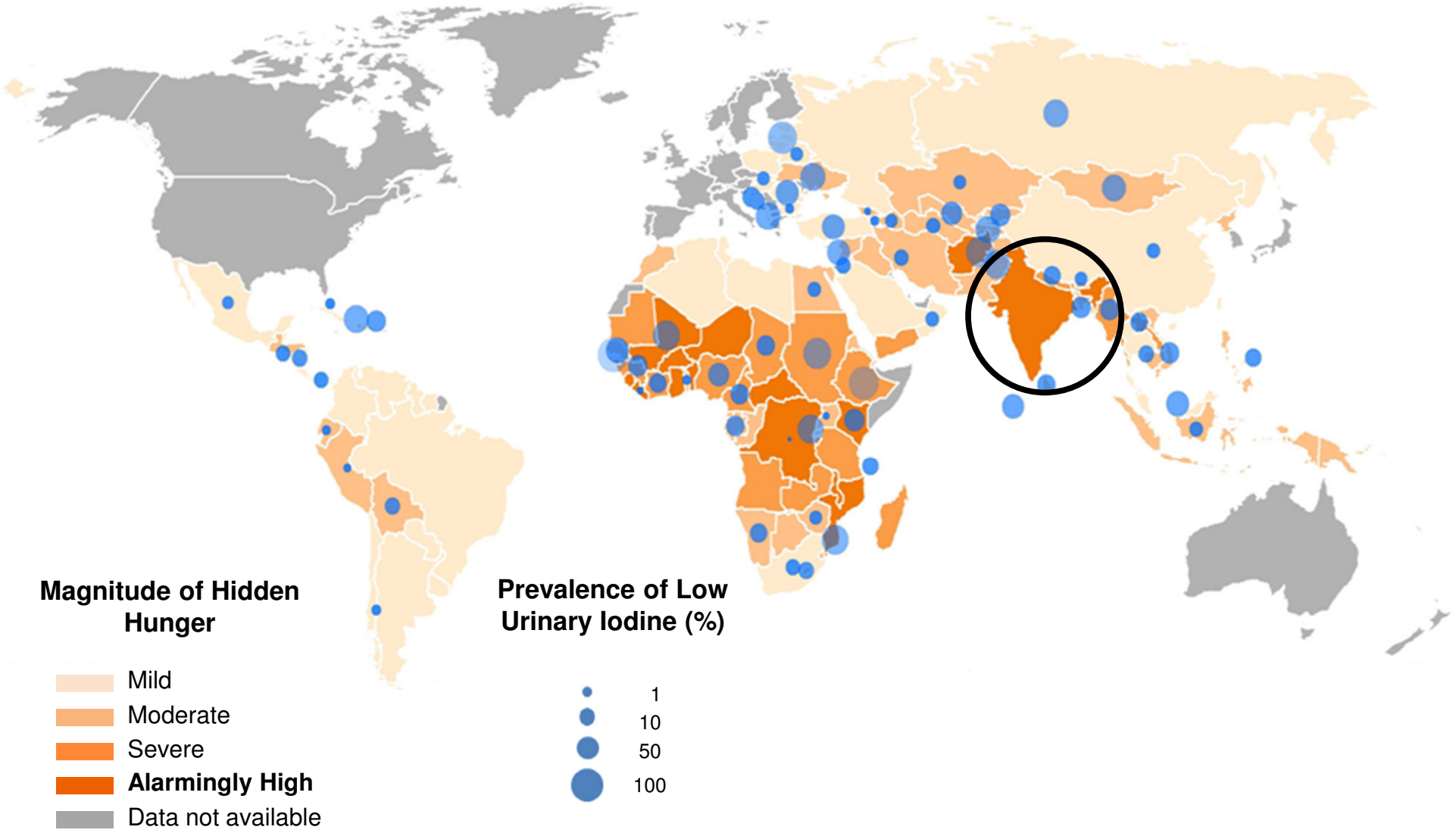
- Micronutrient deficiency /Integrated approach – fortified food
- Sustainable nutrition security-12th Five year Plan
- History of safe use and science based evidence
- Global and National status
- Regulatory issues
- Some concerns

A healthy diet with essential micronutrients is the basis for a Healthy Life

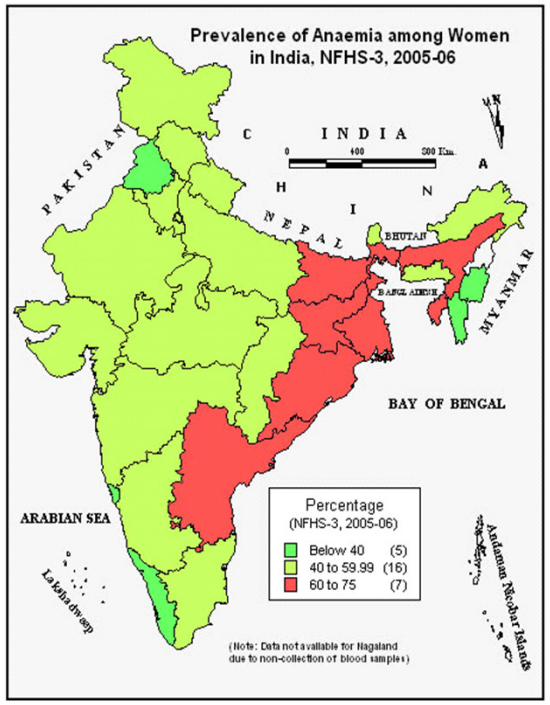


They cannot be produced by the body and have to come from the diet

Worldwide ~ 2 billion people are affected by Hidden Hunger



Muthayya et.al 2013, PLoS ONE 8(6): e67860



Micronutrient deficiency

do not occur in isolation but rather concurrently

Iodine
Iron
Zinc
Vitamin A
Calcium
Vitamin D
Vitamin B12
Folic acid

Nutrient	Median Intake	RDA
Iron	12 mg	17 mg
Vitamin A	124 µg/CU/d	600 µg
Riboflavin	0.8 mg/CU/d	1.4 mg
Vitamin C	29 mg/CU/d	40 mg
Dietary folate	118 µg/CU/d	200 µg

NNMB Technical Report No. 26, 2012/ NFHS

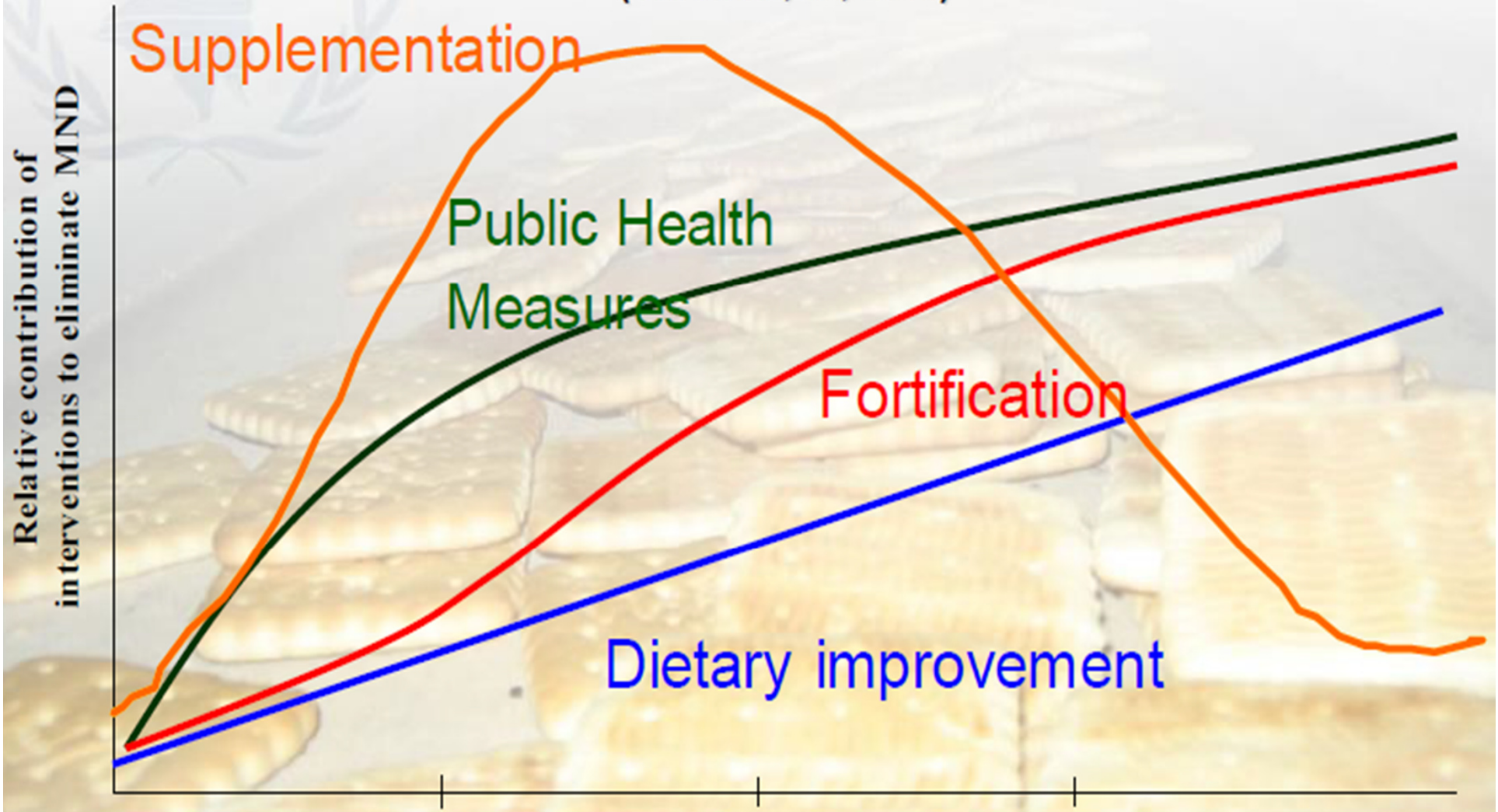
Food fortification is a key approach to achieve adequate micronutrient intake

Codex General Principles
Fortification / Enrichment:

Addition of one or more essential nutrients to a food whether or not it is normally contained in the food, **for the purpose of preventing or correcting a demonstrated deficiency** of one or more nutrients in the population or specific population groups.

Integrated Approaches to eliminate Micronutrient Deficiencies

(V.Mannar, MI, 2003)



Sustainable nutrition security

Food fortification is an innovative strategy has not yet achieved its full potential by fostering convergence within and across sectors and levels of investment.

12th Five year Plan
Reproductive, Maternal & Child Health and Nutrition

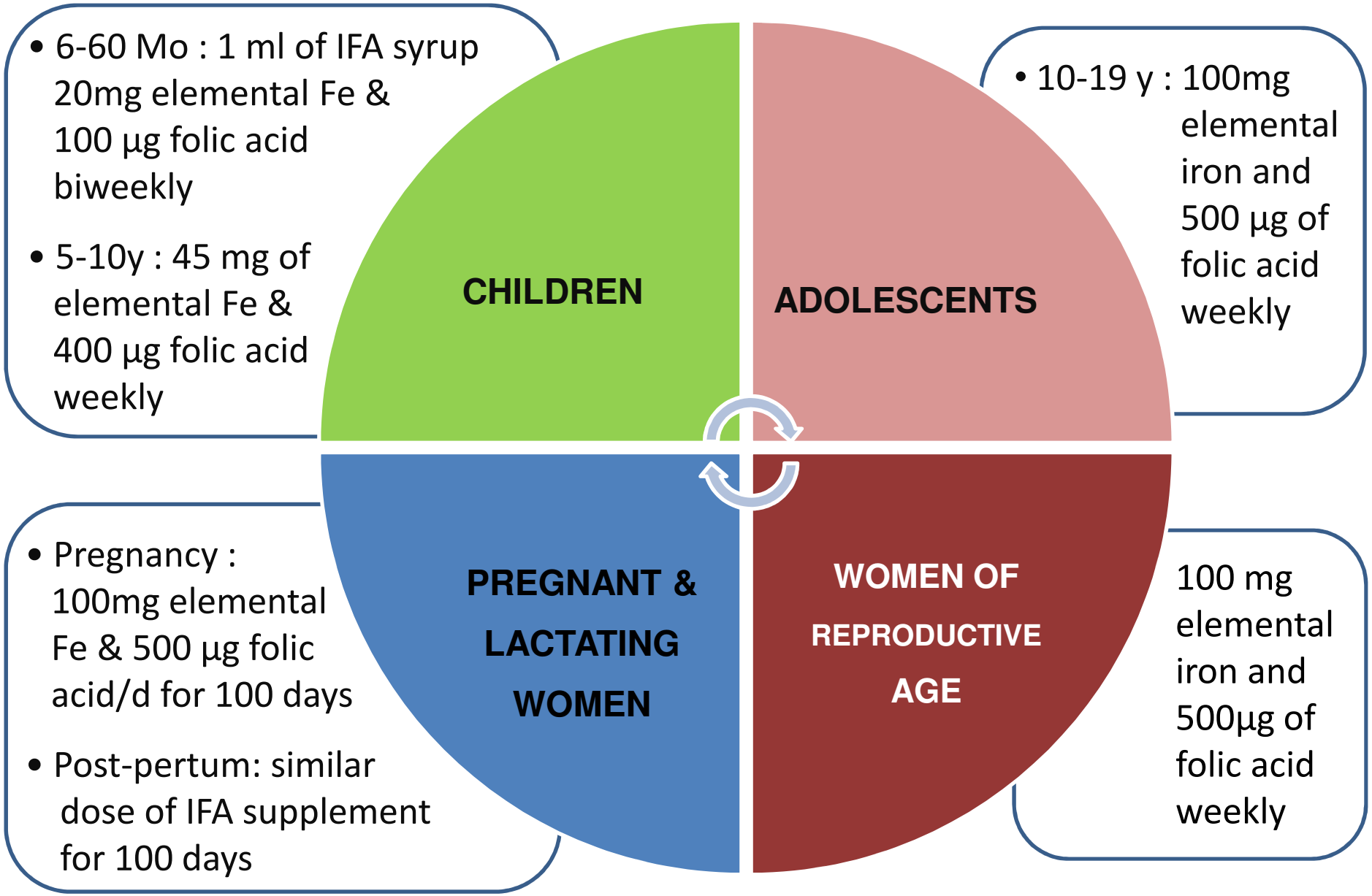
The priority areas in nutrition include

- Inclusion of multi-stakeholders strategies including community participation to maximize nutritional benefits from locally available foods, food fortification, micronutrient supplementation.

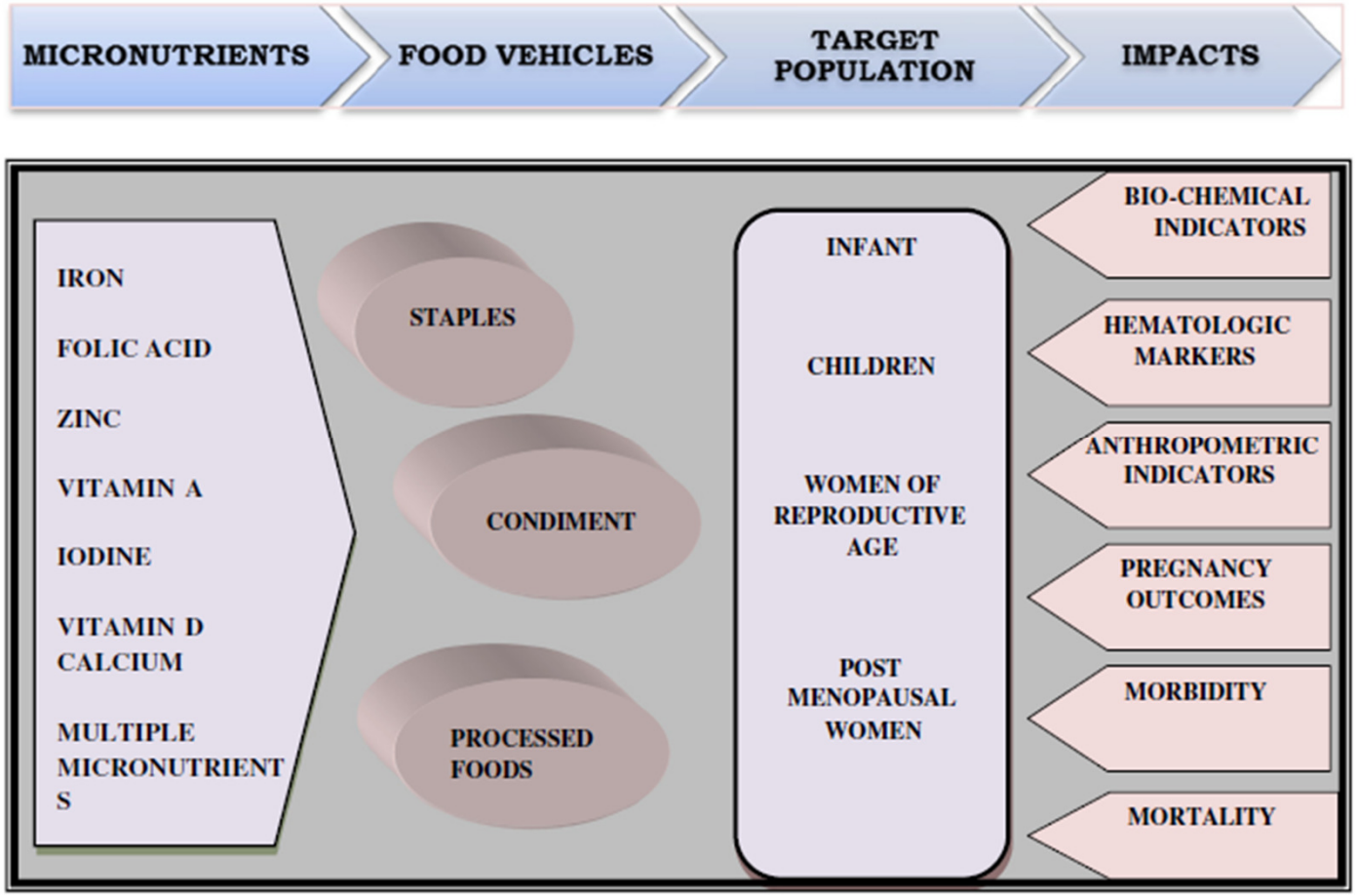
- The three important public health interventions (i) national iron + initiative NRHM (ii) Universal use of iodine and iron fortified salt and (iii) vitamin A supplementation for children aged 6 to 59 months .

- Improve iron bioavailability from Indian diet and micronutrient status

IFA Supplementation through Life Cycle Approach NRHM 2013



Conceptual frame work



Das *et al. Systematic Reviews* 2013, 2:67
http://www.systematicreviewsjournal.com/content/2/1/67

Micronutrient fortification of food and its impact on woman and child health: a systematic review

Jai K Das, Rehana A Salam, Rohail Kumar and Zulfiqar A Bhutta*

Three types of food fortification are in place

Conventional fortification

- Staple foods (flour, sugar, milk, oil, rice)
- Dairy (milk, yoghurt)
- Spreads (margarine)
- Condiments (salt)

Home fortification

- Powder
- Sachets

Bio-fortification

The breeding and genetic modification of plants so as to improve their nutrient content

- Agricultural products (rice, maize, sweet potato,…)

History of safe use and science based evidence on fortified foods

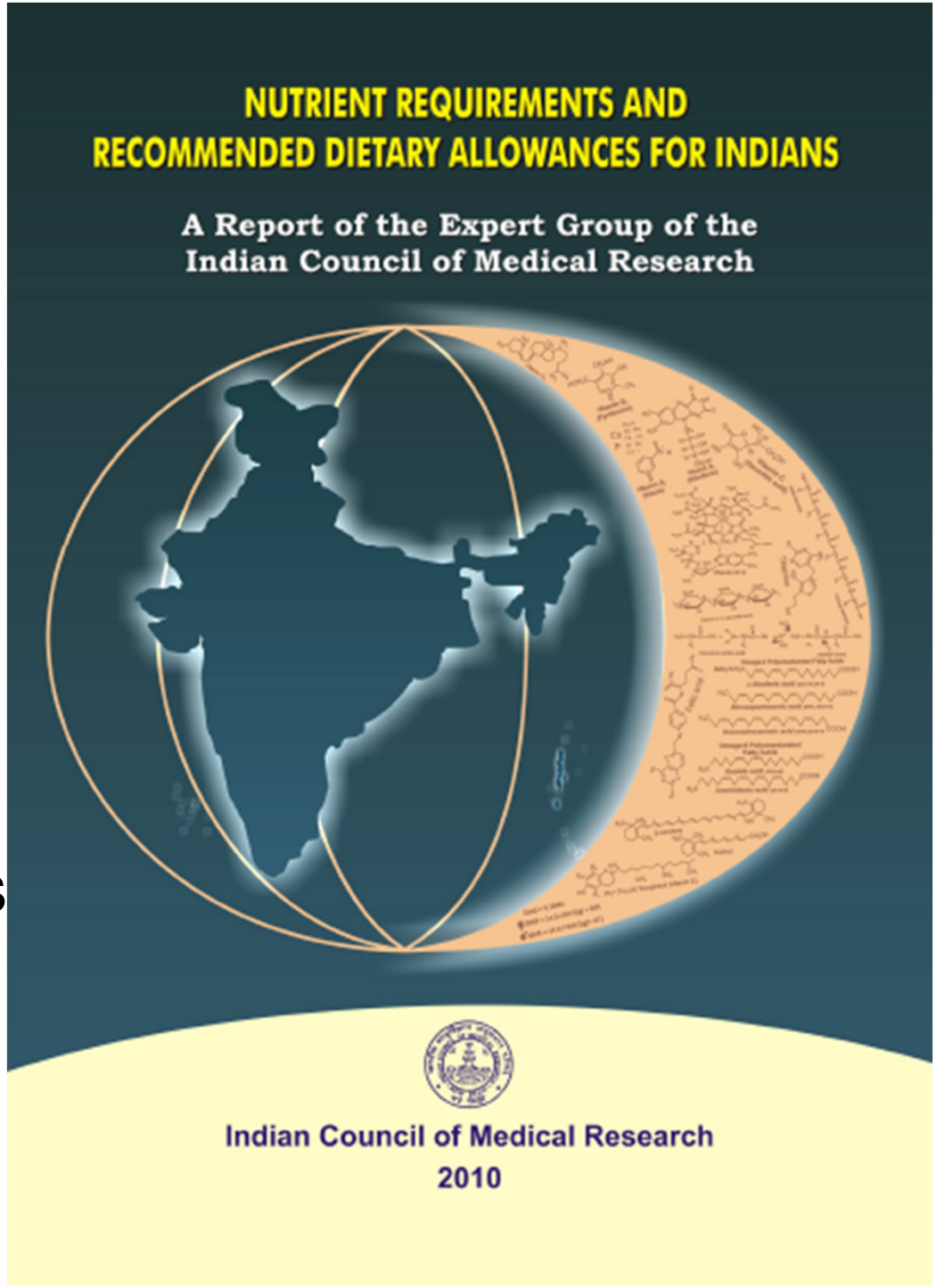
Fortified foods

- Long history of safe use and successful control of deficiencies of vitamins A, D, several B vitamins, iodine and iron in many countries

- Convincing evidence for prevention and control of primary deficiency

Country specific RDA

- Dietary habit- habitual diet, dietary diversity intake, culinary practices, bioavailability
- Nutrient balance
- Factorial Approach
- Tropical country
- Reference body weights
- Environment
- Life style



Functional Impact of Food Fortification Strategies and Programmes : Review of data from 36 countries

Effect
0-1m Neonatal mortality reduced by 65.7% after iodisation
Infants (1-12m) Infant mortality decreased 56.5% after iodisation .
Children (12-59m) Improved MN status - (Hb WMD 7.36g/L,, 2.88-11.84)
Target population: reduction in iron deficiency anemia

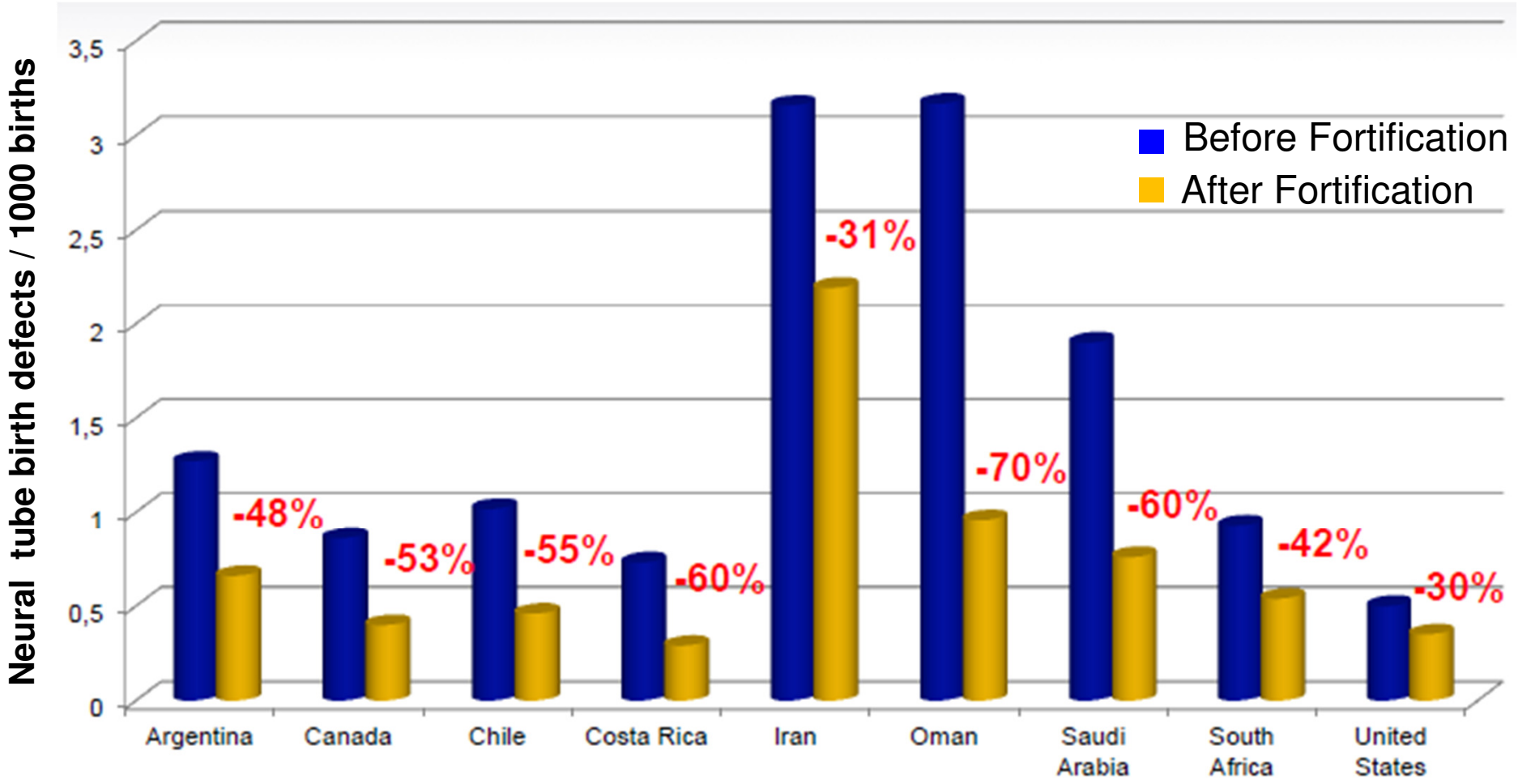
Bhutta et al; Lancet 2008, DOI:10.1016/S0140-6736(07)61693-6

Effect of fortified milk on morbidity in young children in North India

	Intervention (n=316)	Control (n=317)	RR/ Odds ratio (95% CI)	P value
GI MORBIDITY				
Episodes of diarrhoea:	1408	1700	0.82 (0.73-0.93)	0.002
Days of diarrhoea	3277	4010	0.81* (0.77-0.85)	0.00
RESPIRATORY MORBIDITY				
Episodes of acute respiratory illness	195 71	262	0.74 (0.57-0.97)	0.03
Severe episodes of ALRI	79	110	0.72 (0.49-1.05)	0.09
Febrile illness and others	530	621	0.85* (0.76-0.95)	0.006
Days with high fever	2899	3099	0.93* (0.88-0.98)	0.005
Measles	1	8	0.12 (0.02-0.99)	0.05
Antibiotic consumed (doses)	7166	7437	0.96* (0.92-0.99)	0.01

Sazawal et al. 2007; BMJ 334: 140. * Odds ratios

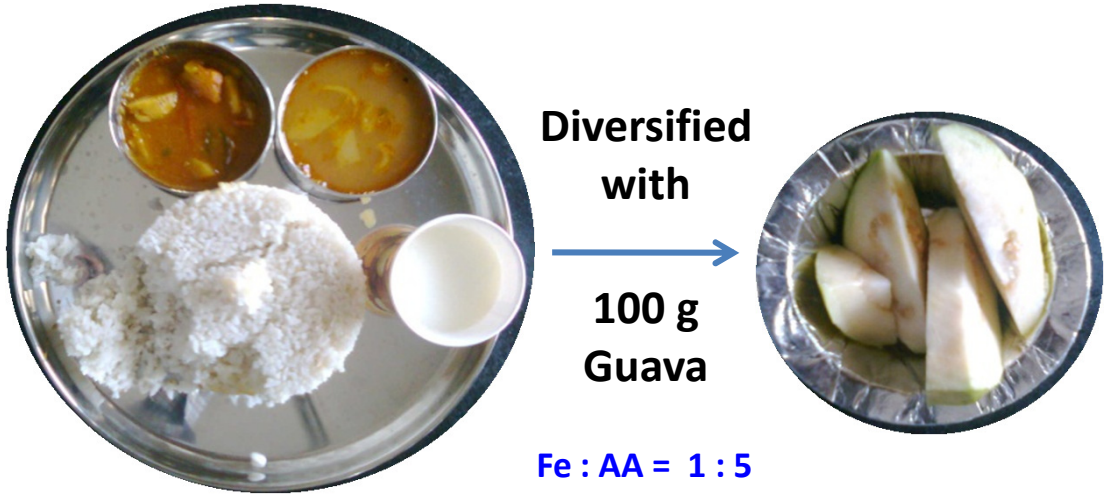
Folic acid Fortification Success

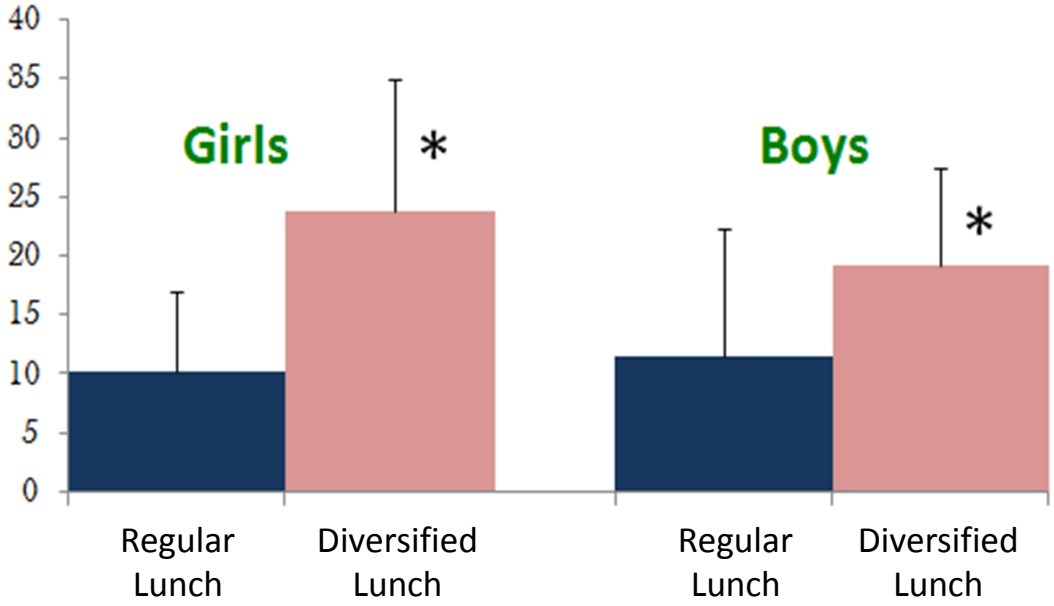


Flour Fortification Initiative , International Grain Congress

Improve iron bioavailability from Indian diet and micronutrient status

Regular meal was diversified with 100g guava among adolescent girls-boys and iron absorption was estimated for both the meals using stable isotope technique.





Diversified meal found to increase iron absorption by 2 times among both the girls and boys.

Nair et. al 2013, J Nutr; 143: 852-858

Safety of Fortified Foods

Experiences in countries that are already fortifying show that fortified food –

- completely safe for consumers: As amount of vitamins and minerals added to a specific food is usually set at individuals daily requirements. It is usually less than one third of the total RDA.
- benefits are enormous
- has negligible impact on the shelf life of the product

Regulatory Issues

Food Safety and Standards Authority of India (FSSAI)

Specific and focused deliberation among all the stakeholders with respect to

- the micronutrients that need to be considered
- whether to consider single or multiple micronutrients
- levels and possible vehicles
- guidelines

National Institute of Nutrition, Hyderabad

MINUTES OF "STAKEHOLDER CONSULTATION ON REGULATION FOR STAPLE FOOD FORTIFICATION" MEETING HELD ON 15th APRIL 2011

Guidelines on the level of fortification of:

Wheat flour-multiple micronutrients

Maida- multiple micronutrients

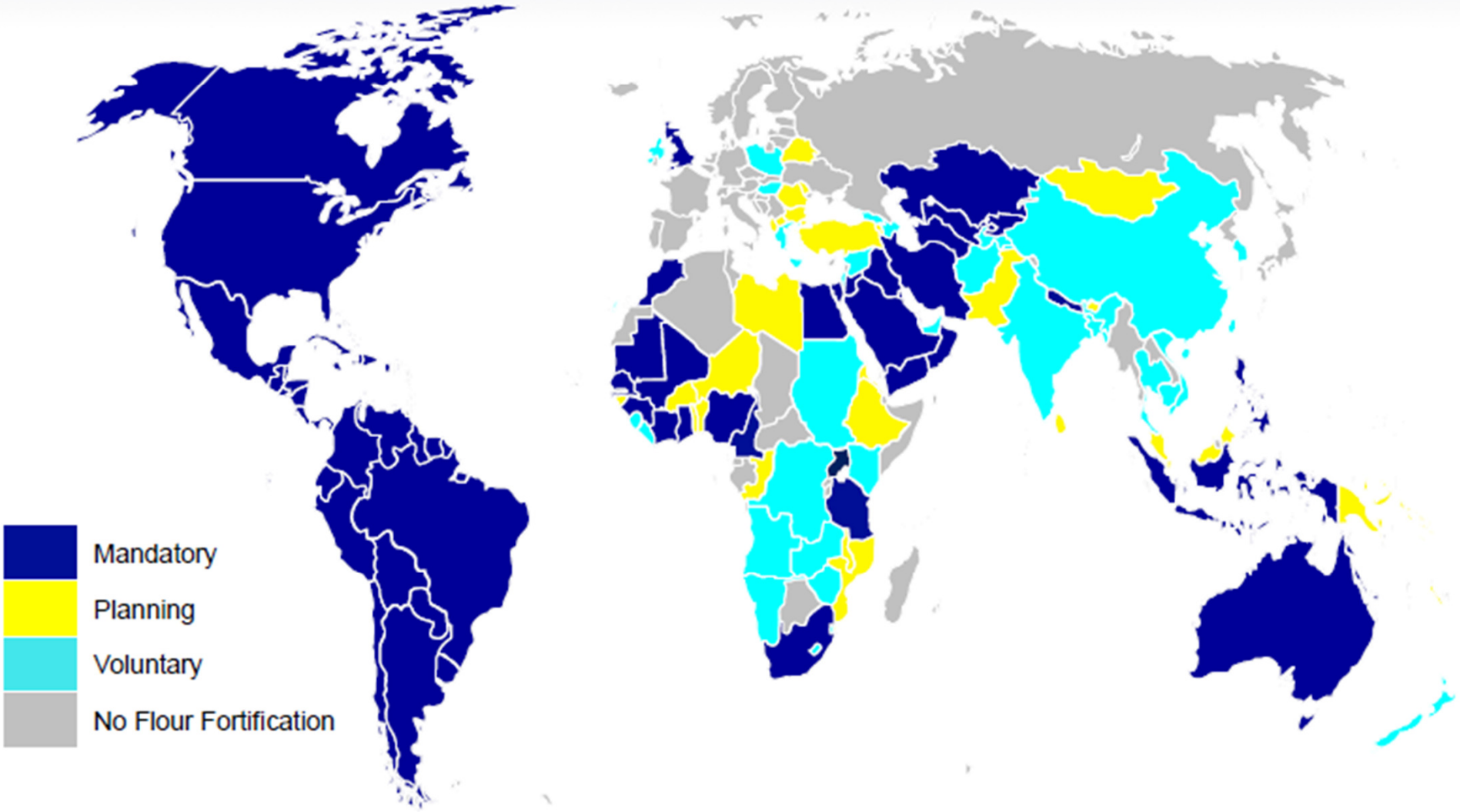
Salt- iodine and iron

Vegetable oil –vitamin A and D

Milk- vitamin A and D

Wheat Flour Fortification Status

March 2012: Fortifying with at least iron and/or folic acid



Flour Fortification Initiative

Double Fortified Salt

Composition: 1 mg of iron and 15 microgram iodine per gram of salt

Introduction of DFS in ICDS, MDM and PDS.

Notification from Prime Minister's office on April 2011 as part of controlling iron deficiency anemia among the beneficiaries.

Supplementary Nutrition under ICDS Scheme – Revision of Nutritional norms.

5. The revision of the guidelines for supplementary nutrition under ICDS has be carefully considered by the Government. Taking into account the percentage of the vulnerable groups not receiving even 50% of the Recommended Dietary Allowanc (RDA), it has been decided to provide 50% of the RDA for different micronutrients t months to 6 years old children through 80g of ready-to-eat energy food/raw fc material. The percentage of children under six years receiving less than 50% of R for micronutrients is annexed.

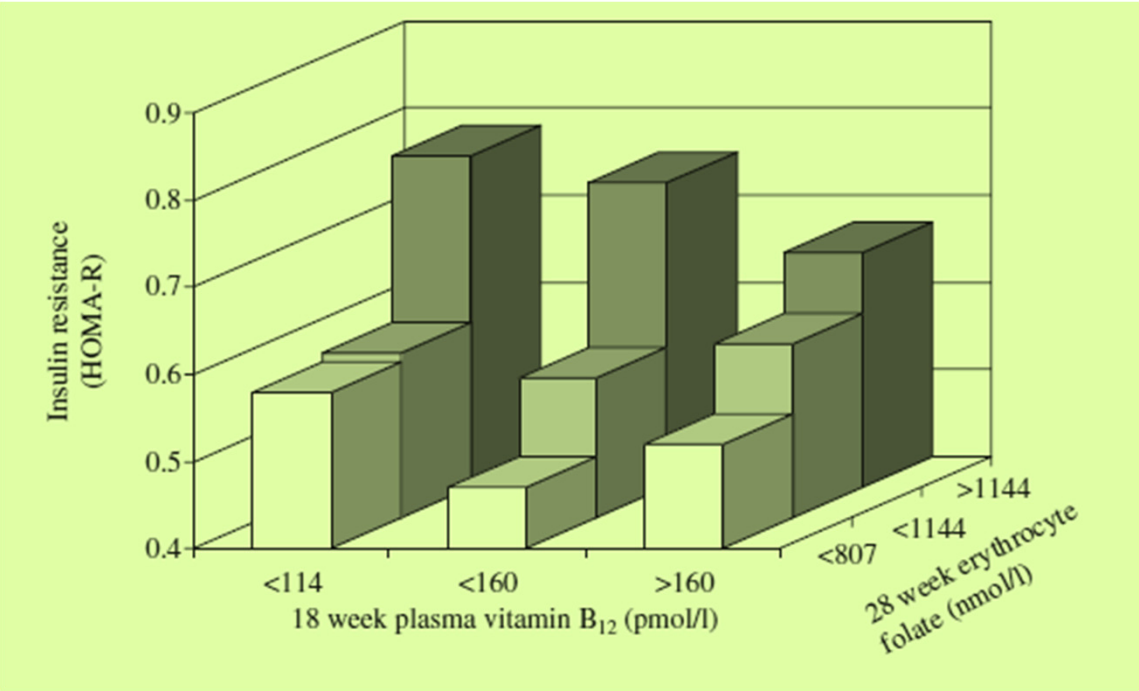
6. The mean RDA for children 6 months to 6 years and the 50% of RDA are under:

Micronutrients	Average RDA	50% of RDA
Calcium (mg)	450	225
Iron (mg)	15	7.5
Iodine (ug)	100	50
Zinc (mg)	10	5
Vitamin A (ug)	400	200
Riboflavin (mg)	0.9	0.5
Ascorbic acid (mg)	40	20
Folic Acid (ug)	35	20
Vitamin B_{12} (ug)	0.2-1.0	0.5

What are the concerns

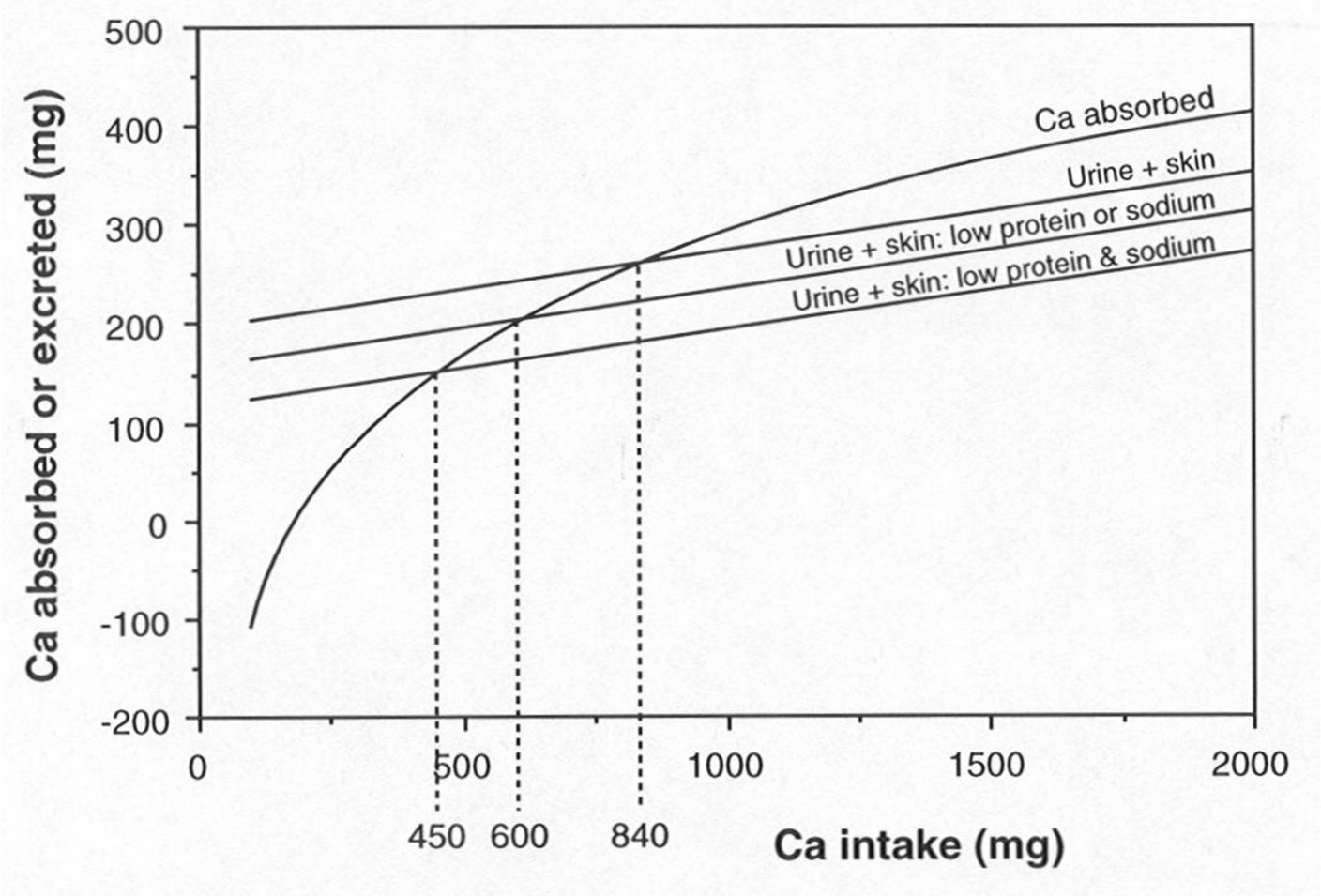
- **Prevailing life-style**
- **impact of co-exposure (folate /B12; Ca/protein and salt)**
- **Tran generational impact of nutritional supplements**
- **Level of fortifications**
- **Risk assessment**

Interactions between nutrients



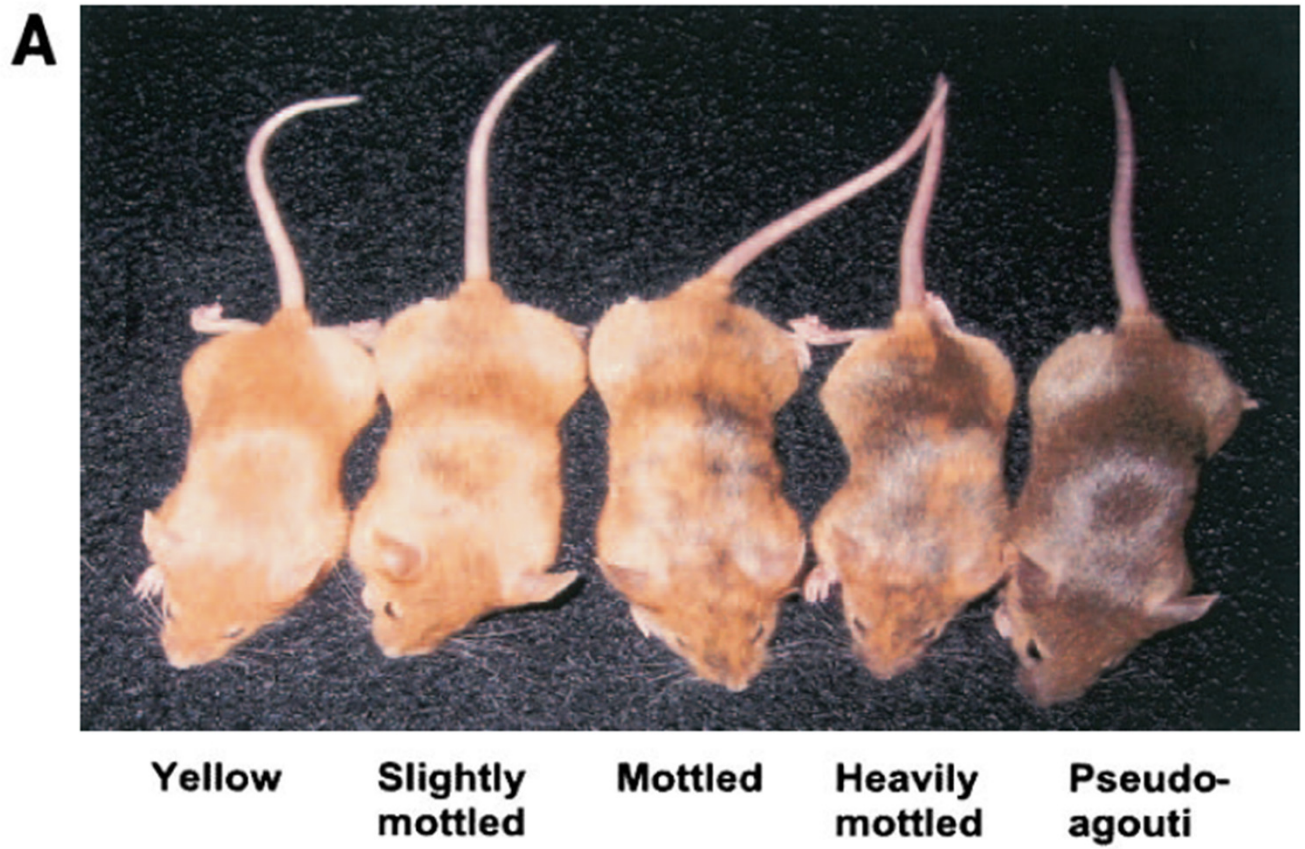
Insulin resistance (HOMA-R) in the children at 6 y in relation to maternal vitamin B12 (18 weeks) and erythrocyte folate (28 weeks) Yajnik et al., Pune maternal Nutrition study, Diabetologia, 2008, 51: 29-32.

The effect of varying protein or sodium intake on theoretical calcium requirement



Reducing animal protein intakes by 40 g reduces the intercept value and requirement to 600 mg. Reducing both sodium and protein reduces the intercept value to 450 mg.

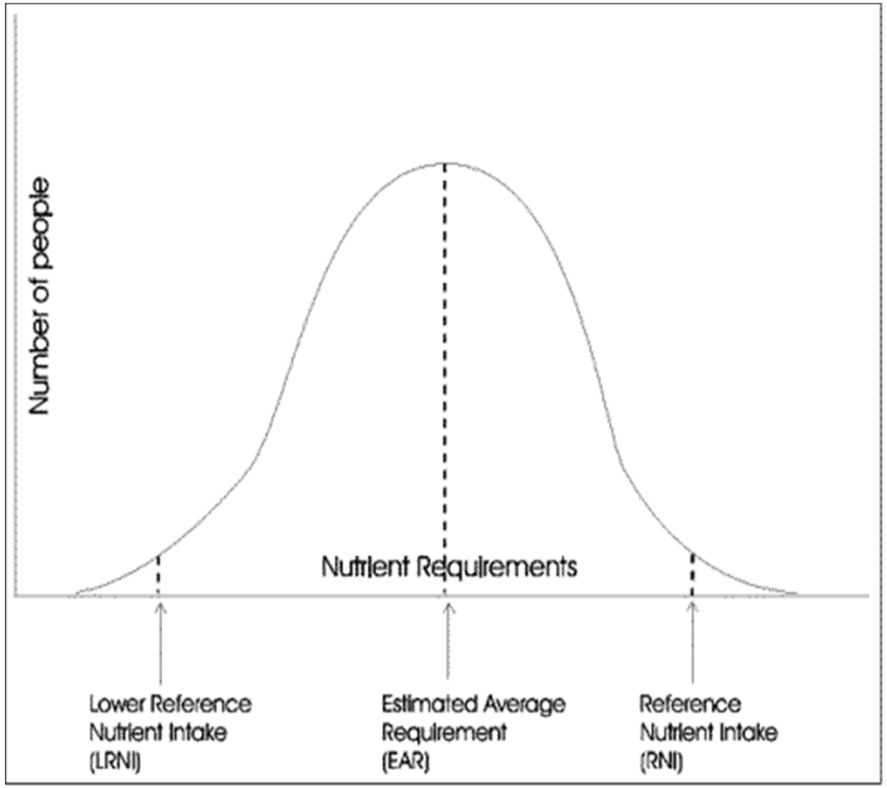
Tran generational impact of nutritional supplements



Study suggests mechanism for influence of maternal nutrition on infant health when supplemented with vitamin B12, folic acid, choline and betaine before, during and after pregnancy. The animals gave birth to thin, brown pups. Control animals' offspring were fat and yellow Waterland RA, Jirtle RL. Mol Cell Biol. 2003 Aug;23(15):5293-300

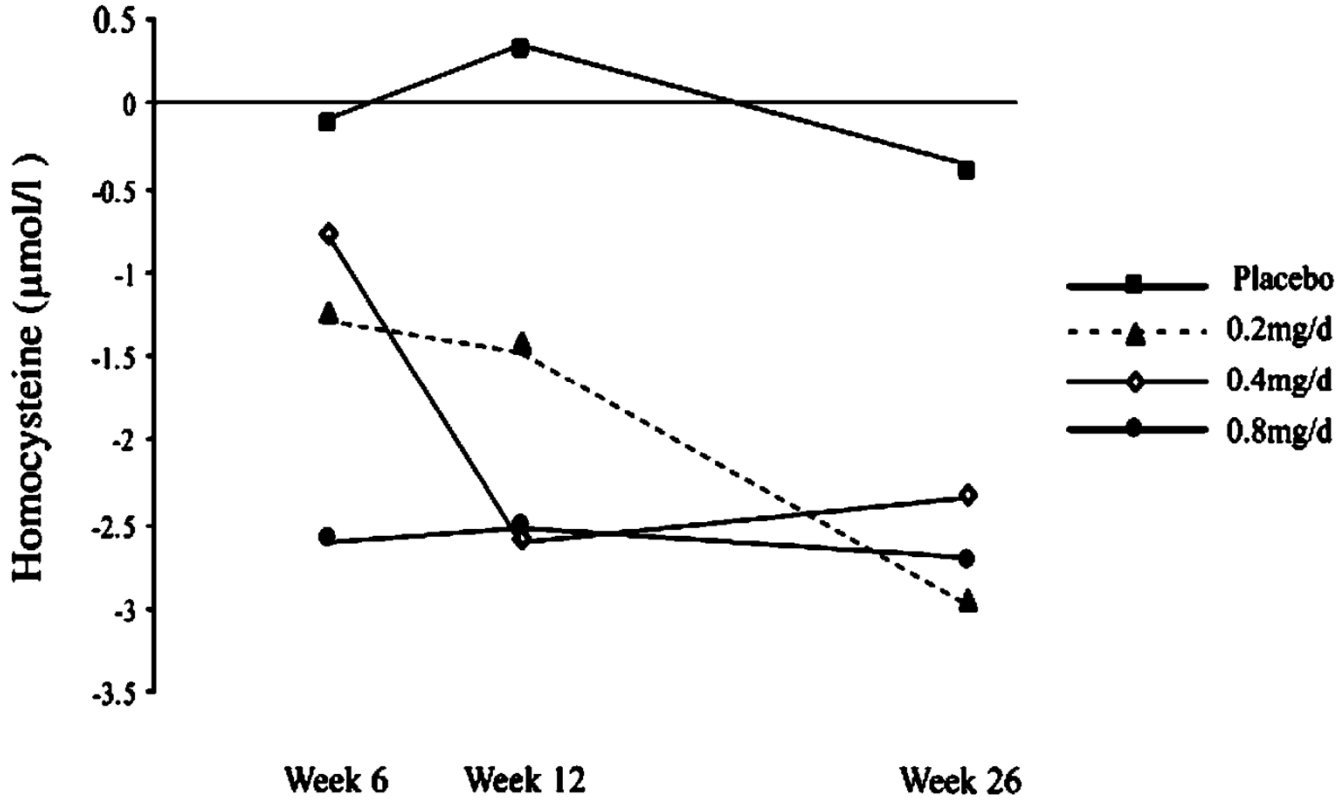
Level of fortification –RDA
Distribution of Nutrient Requirements

Assumes a Gaussian (normal) distribution



- **LRNI** "An amount enough for only the few people in a group who have low needs"
- **EAR** "About half will usually need more than the EAR and half less"
- **RDA** "An amount of the nutrient that is enough, or more than enough, for about 97% of people in a group"

Dosage



Homocysteine response to folic acid over 26 wk of intervention in patients with ischemic heart disease. A subsample of the participants also underwent sampling at 6 or 12 wk (week 6, n = 34; week 12, n = 72; week 26, n = 101; not the same participants). The homocysteine response was calculated as the posttreatment minus pretreatment value. See Table 2 for a statistical comparison of homocysteine responses between all participants (n = 172).

Tighe et al., A dose-finding trial of the effect of long-term folic acid intervention: implications for food fortification policy, Am J Clin Nutr 2011;93:11–8

Conclusions

- For achieving micronutrient security, optimum mix of supplementation, dietary diversification, fortification, biofortification, and health services should be defined depending on local context.
- Ensure consumption of fortified foods with absorption modifiers in adequate amounts by target population
- trans disciplinary approach to science, policies, and actions- Multi-stakeholders strategies.

Thank You …