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**Impact of Novel Food Ingredients and Additives  
on human health: Role of Fortification**

**Prof. Yogeshwer Shukla**

Area Coordinator, Food Drug & Chemical Toxicology  
Head, Proteomics Laboratory

**CSIR-Indian Institute of Toxicology Research, Lucknow**

# Hidden hunger could be robbing India of its potential

Times of India: Apr 29, 2017



**INDIA** ranks **97** among **118** nations on the Hunger Index



184mn Indians, including many children, are undernourished

- ⊕ Almost **48%** children under **5 years** are stunted
- ⊕ **60%** are anaemic
- ⊕ **70%** consume less than **50%** of the daily recommended micronutrients

## ⊕ What constitutes micronutrient deficiency?

- ⊕ Micronutrient deficiency, also known as hidden hunger, refers to inadequate intake of crucial vitamins and minerals - such as zinc, vitamin A and folate - needed for healthy mental and physical growth of children

## What are its effects



Stunting in children



Weakened immune systems



Impaired cognitive function



Anaemia, low energy levels

## THE SOLUTION

A diverse diet including



Variety of cereals



Legumes



Fruits & vegetables



Animal - source foods



Fortified foods and drinks with micronutrients

# Nutraceuticals: Let food be your medicine

## Classified as:

### Functional Foods

Food that have been either enriched or fortified, a process called fortification.



### Novel Foods

- Food or food ingredients which has no significant history of human consumption within the European community prior to May 1997.



### Dietary Supplements

Products contains nutrients derived from food products that are concentrated in liquid or capsule form.



# Producing Functional Foods

**Addition of one or more components**

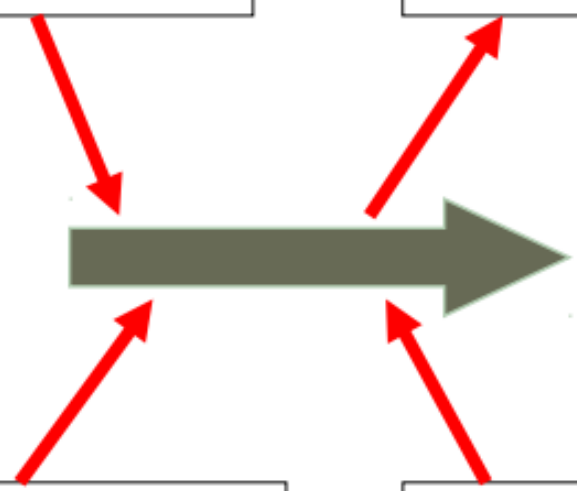
**Removal of one or more components**

**Food**

**Functional Food**

**Concentration of one or more components**

**Modification of one or more components or its/their bioavailability**



# Food Fortification

**WHO** – “The process whereby nutrients are added to foods (in relatively small quantities) to maintain or improve the quality of the diet of a group, a community or a population



For example:

- addition of iodine to salt to decrease iodine deficiency disorders such as goiter.
- addition of a nutrient may also offer some technical benefit (for example, vitamin C is an antioxidant and can reduce the rate of spoilage in some products), or a direct health benefit for a subgroup of the population (for example fortification of flour with folic acid to prevent neural-tube defects in babies).

## Fortification of breakfast cereals

Breakfast cereals are fortified in many countries, with micronutrients including B vitamins, iron, calcium and vitamin D.

This can provide a valuable contribution to the diet of breakfast cereal con



## Milk treated with UV light for increasing vitamin D content

- ✿ Vitamin D fortification of milk and milk products began in the 1930s.
- ✿ Vitamin D is essential for calcium absorption and is involved in the mineralization process required for bone growth. Deficiency of vitamin D causes rickets (softening of bones) in children and osteomalacia in adults.
- ✿ Recent studies also suggest that vitamin D plays a role in prevention of prostate, breast, and colorectal cancers.
- ✿ The fortification of milk with vitamin D almost eliminated the public health concern of rickets in the 19th century.



## The bioconversion of the beta carotene in Golden Rice to Vitamin A is better than from conventional food sources

- ~40 g per day of Golden Rice, with 6  $\mu\text{g}$ / gram of  $\beta$ -carotene can provide >40% of the estimated average requirement daily.
- Sufficient to combat morbidity and mortality from Vitamin A deficiency.





## Fortification activities in India

- Iodization of salt: Iodization of salt with potassium iodate started in 1962 in a few districts and has since covered most states and union territories.
- Fortification of vanaspati: Fortification of vanaspati with vitamins A and D started more than 50 years ago and has been obligatory in India since 1953.
- Fortification of milk: The department of food, ministry of food and civil supplies, government of India, pioneered and initiated fortification of milk with vitamin A in 1980, by providing technical as well as financial support.
- Presently, many milk dairy federations/cooperatives, including Mother Dairy, are fortifying milk with vitamin A.
- Both iodization of salt and fortification of vanaspati are mandated under the law and milk fortification is strongly recommended in the National Nutrition Policy.

## Case Study

# **Food fortification as a complementary strategy for the elimination of micronutrient deficiencies: case studies of large scale food fortification in two Indian States**

Sadhana Bhagwat MD, Deepti Gulati MSc, Ruchika Sachdeva MSc, Rajan Sankar MD

- ✿ Global Alliance for Improved Nutrition (GAIN) is supporting large-scale, voluntary, staple food fortification in Rajasthan and Madhya Pradesh because of the high burden of malnutrition, availability of industries capable of and willing to introduce fortified staples, consumption patterns of target foods and a conducive and enabling environment.

- ✿ High extraction wheat flour from roller flour mills, edible soybean oil and milk from dairy cooperatives were chosen as the vehicles for fortification.
- ✿ Over 260,000 MT of edible oil, 300,000 MT of wheat flour and 500,000 MT of milk are being fortified annually and marketed.
- ✿ Rajasthan is also distributing 840,000 MT of fortified wheat flour annually through its Public Distribution System and 1.1 million fortified Mid-day meals daily through the centralized kitchens.

# How is the process of setting micronutrients recommendations reflected in nutrition policies in Poland? The case study of folate

Ewa Sicińska<sup>1</sup>, Marta Jeruszka-Bielak<sup>1</sup>, Wojciech Roszkowski<sup>1</sup>, Anna Brzozowska<sup>1</sup>,  
Mirosław Jarosz<sup>2</sup>, Monique M. Raats<sup>3</sup>

- ✿ This study aims to elucidate the process of setting nutrition recommendations and the development of subsequent policies associated with micronutrients in Poland by using the case study of folate.
- ✿ Since 1997, the Experts Group of the Ministry of Health recommended that all women of childbearing age should consume folic acid as a supplement to prevent neural tube defects in their offspring.

# Myths of Food Fortification

- ❖ Food Fortification costs are very high
- ❖ Food Fortification changes colour, flavour, texture of foods
- ❖ Food Fortification needs expensive equipments
- ❖ Food Fortification may increase risk of toxicity or overdosing of vitamins
- ❖ Food Fortification is not a long term strategy for delivering the nutrients
- ❖ Food Fortification requires specialized trained manpower
- ❖ Food Fortification is a commercial gimmick for food industry

# Report: Risks Associated with Fortified Foods (Vit. A)

- ✿ Excessive vitamin A intake from foods or supplements can lead to liver damage, bone abnormalities, peeling skin, brittle nails, and hair loss, the report's authors write.
- ✿ Excessive vitamin A intake during pregnancy can result in abnormalities in the fetus, the report says
- ✿ Eating foods naturally high in vitamin A, such as carrots or pumpkin, is considered safe

# Vit A intake and hip fractures among postmenopausal women

- Long-term consumption of high vitamin A diets may contribute to osteoporosis & hip fracture.

	Quintiles of Vitamin A consumption					P for trend
	< 1250	1250-1699	1700-2249	2250-2999	≥3000	
Food & supplements $\mu\text{g}/\text{d}$						
Multivariate RR (95% CI)	1.00	0.92 (0.70-1.22)	1.13 (0.85-1.49)	1.24 (0.92-1.68)	1.48 (1.05-2.07)	<b>0.003</b>
Food only, $\mu\text{g}/\text{d}$	<1000	1000-1299	1300-1599	1600-1999	≥2000	
Multivariate RR (95% CI)	1.00	1.51 (0.86-2.66)	1.37 (0.74-2.51)	1.74 (0.96-3.14)	1.82 (0.97-3.40)	0.24

*Conti.....*

	Quintiles of Retinol consumption					P for trend
Food & supplements $\mu\text{g}/\text{d}$	< 500	500-849	850-1299	1300-1999	$\geq 2000$	
Multivariate RR (95% CI)	1.00	1.25 (0.95-1.65)	1.18 (0.88-1.59)	1.43 (1.04-1.96)	1.89 (1.33-2.68)	<b>&lt;0.001</b>
Food only, $\mu\text{g}/\text{d}$	<400	400-549	5500-699	700-999	$\geq 1000$	
Multivariate RR (95% CI)	1.00	1.27 (0.77-2.07)	0.96 (0.57-1.63)	1.41 (0.86-2.32)	1.69 (1.05-2.74)	<b>0.05</b>

	Quintiles of Beta Carotene consumption					P for trend
Food & supplements $\mu\text{g}/\text{d}$	< 2550	2550-3549	3550-4649	4650-6299	$\geq 6300$	
Multivariate RR (95% CI)	1.00	1.18 (0.91-1.53)	1.03 (0.77-1.37)	1.27 (0.96-1.69)	1.22 (0.90-1.66)	<b>0.1</b>
Food only, $\mu\text{g}/\text{d}$	<2500	2500-3449	3450-4549	4550-6099	$\geq 6100$	
Multivariate RR (95% CI)	1.00	1.06 (0.66-1.69)	1.36 (0.85-2.16)	1.12 (0.67-1.87)	1.36 (0.81-2.30)	<b>0.94</b>

Thus, long term intake of a diet high in retinol may promote the development of osteoporotic hip fractures in women.

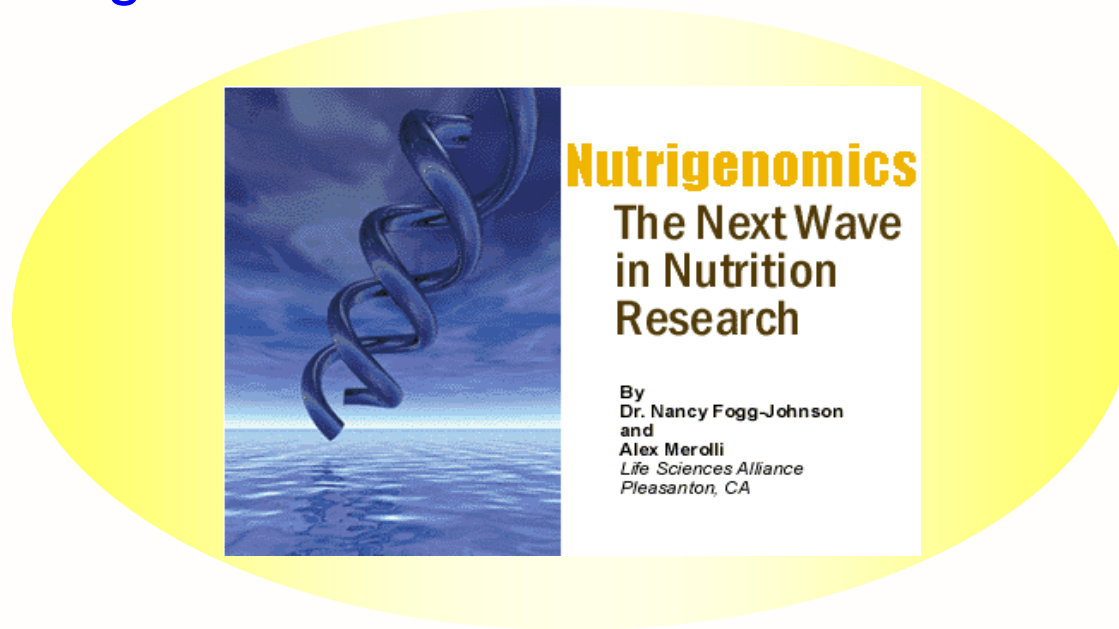


# Future Challenges of Food Fortification

1. Create community awareness about benefits of food fortification.
2. Private Sector, Governments & International Agencies need to make commitments for investing in food fortification.
3. Ensure increased availability of fortified foods to the vulnerable groups of populations.

## Scientific contribution in nutrition research

- ✿ The new era in nutrition science is called “nutrigenomics”. It is believed that nutrigenomics will revolutionize wellness and disease management.



- ✿ Food and pharma companies worldwide have recognized the commercial opportunities and have embarked on substantial nutrigenomics efforts.

Screening for  
new functional food  
bioactives *in vitro*

Quality and  
authenticity  
of foods

Safety testing

Food  
processing

**Nutri-genomics**

Animal

Plant & Microbials

Production of  
food  
ingredients

Human

Efficacy testing

Biomarker  
development

Genotyping

# The food industry is growing towards development of a third generation of functional foods

## 1st generation

### *supplements*

- vitamin supplements
- calcium enrichment
- fibers

1. Components with established efficacy
2. Research based on epidemiology

## 2nd generation

### *whole foods*

- broccoli
- yoghurts
- green tea
- Whole grain products

1. Research based on safety and efficacy assessment: 'discovery' of positive effects of food compounds
2. Identification of active components

## 3rd generation

### *enhanced foods or novel foods*

- novel ingredients
- novel products

1. Newly developed functional ingredients/foods based mechanistically proven on efficacy.
2. Research based on pharma screening: effect targeted development, lead optimization and bioavailability.

## Concluding Lines

- ❖ Food related diseases and malnutrition is a public health significant problems.
- ❖ Food fortification is one of the most cost-effective nutrition interventions to tackle Hidden Hunger on a large scale.
- ❖ Novel foods with addition of new nutrients or enrichment of natural nutrient should be bring in.
- ❖ Major strategies to approach the public for awareness on food safety and malnutrition should be formulated.



सीएसआईआर-भारतीय विषविज्ञान अनुसंधान संस्थान  
CSIR-INDIAN INSTITUTE OF TOXICOLOGY RESEARCH

वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद्  
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