FOOD SAFETY AND STANDARDS AUTHORITY OF INDIA
Inspiring Trust, Assuring Safe & Nutritious Food
Ministry of Health and Family Welfare, Government of India

CHIFSS
CII-HUL Initiative on Food Safety Sciences

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

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Hidden hunger could be robbing India of its potential

Times of India: Apr 29, 2017

184mn Indians, including many children, are undernourished

- Almost **48%** children under **5 years** are stunted
- **60%** are anaemic
- **70%** consume lessthan **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.

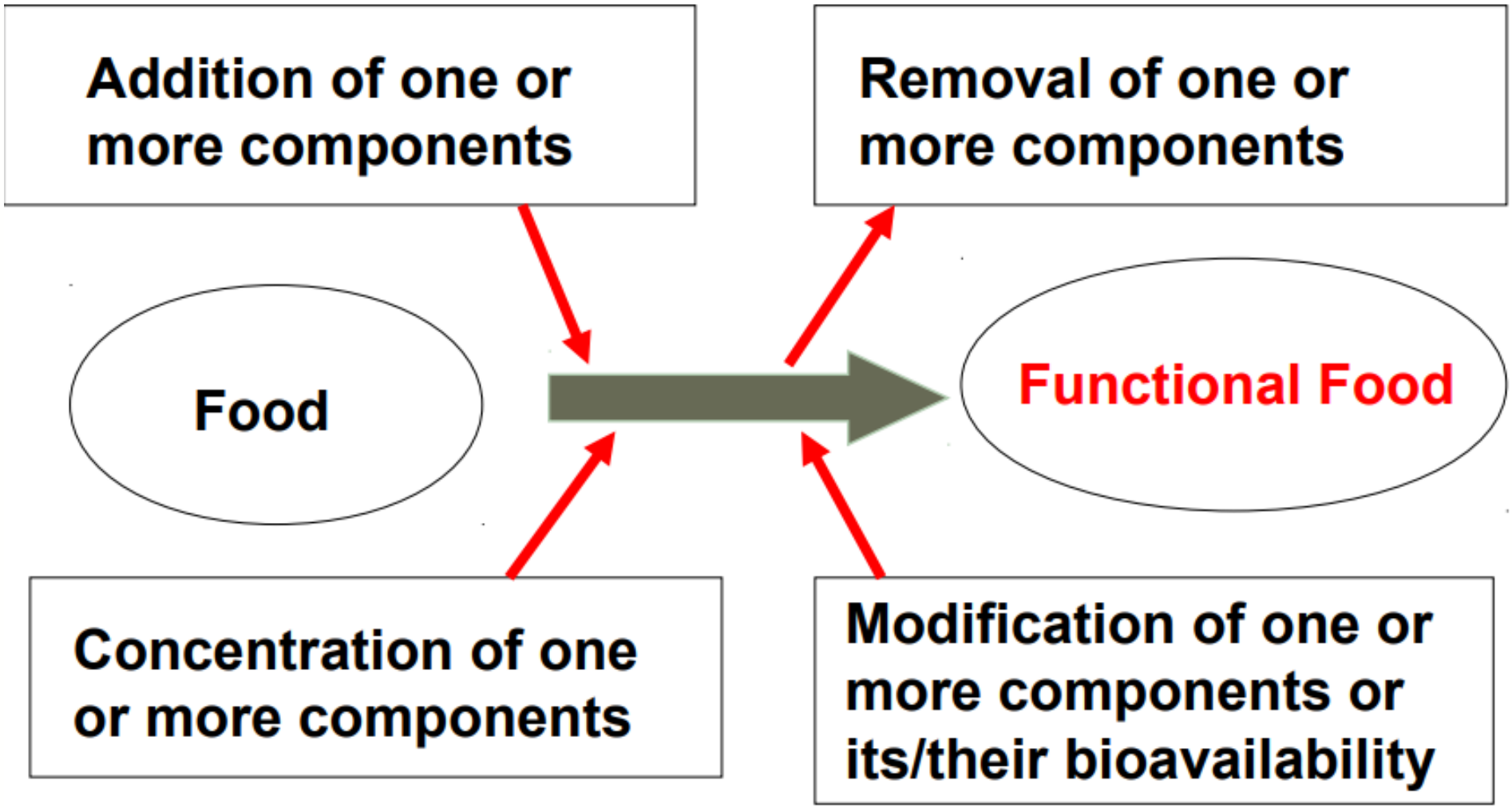
Novel Foods

- 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



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 cor

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 µg/ gram of β-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.

S4 *Asia Pac J Clin Nutr 2014;23 (Suppl):S4-S11*

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.

Annals of Agricultural and Environmental Medicine 2018, Vol 25, No 1, 82–86
www.aaem.pl

ORIGINAL ARTICLE

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

Ewa Sicińska[1], Marta Jeruszka-Bielak[1], Wojciech Roszkowski[1], Anna Brzozowska[1], Mirosław Jarosz[2], Monique M. Raats[3]

- 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
Food & supplements µg/d	**< 1250**	**1250-1699**	**1700-2249**	**2250-2999**	**≥3000**	
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)	**0.003**
Food only, µg/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**

Feskanich D et al. *JAMA. 2002;287(1):47-54.*

Conti…..

	Quintiles of Retinol consumption					P for trend
Food & supplements µg/d	**< 500**	**500-849**	**850-1299**	**1300-1999**	**≥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)	**<0.001**
Food only, µg/d	**<400**	**400-549**	**5500-699**	**700-999**	**≥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)	**0.05**

	Quintiles of Beta Carotene consumption					P for trend
Food & supplements µg/d	**< 2550**	**2550-3549**	**3550-4649**	**4650-6299**	**≥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)	**0.1**
Food only, µg/d	**<2500**	**2500-3449**	**3450-4549**	**4550-6099**	**≥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)	**0.94**

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

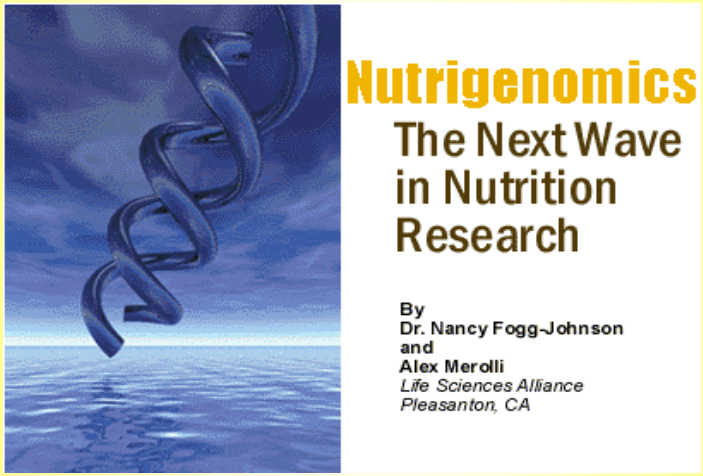
1. Create community awareness about benefits of food fortification.

2. Private Sector, Governments & International Agencies need to make commitments for investing in food fortification.

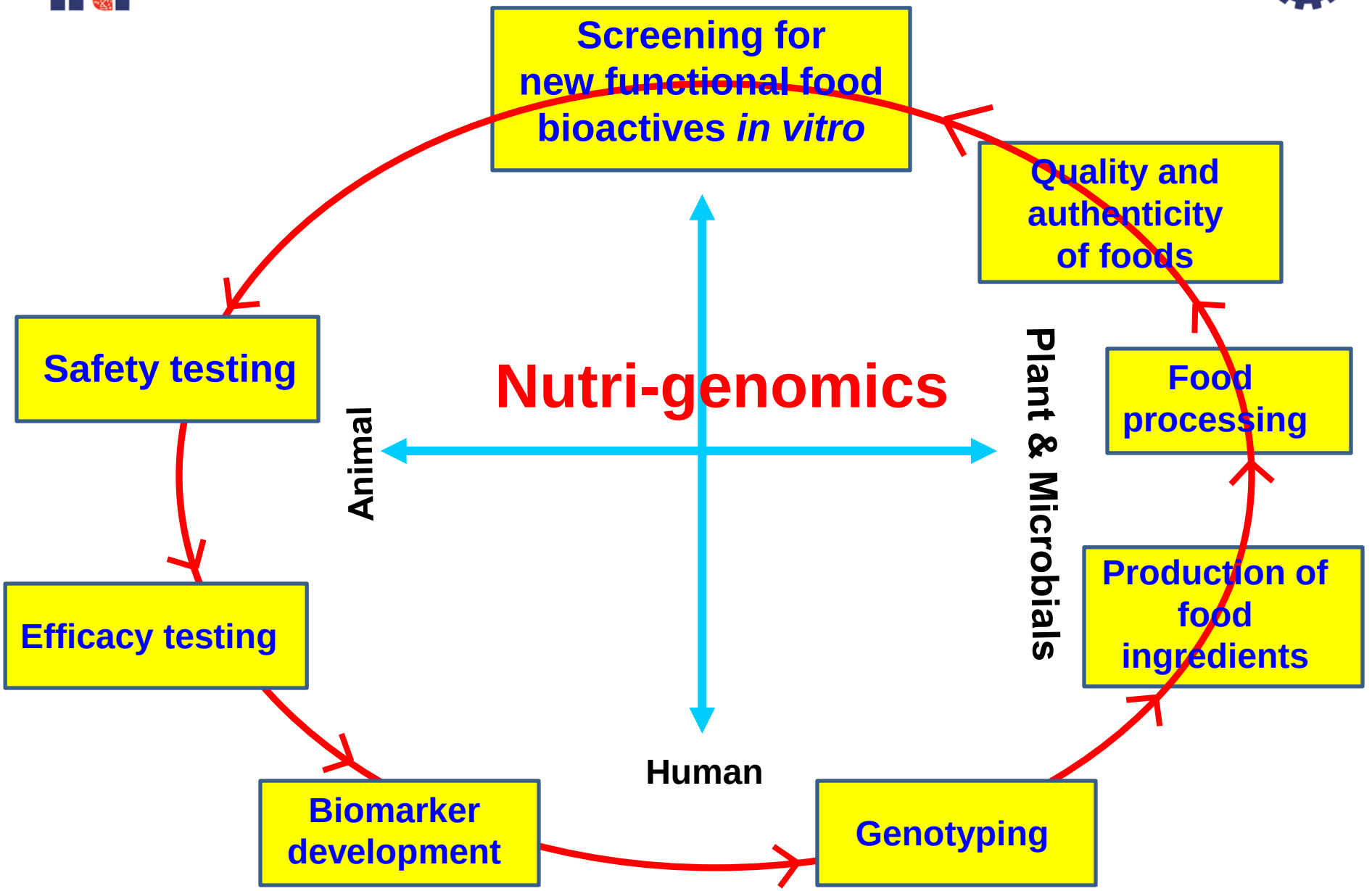
3. Ensure increased availability of fortified foods to the vulnerable groups of populations.

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
Food processing
Production of food ingredients
Genotyping
Biomarker development
Efficacy testing
Safety testing
Nutri-genomics
Animal
Plant & Microbials
Human

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.


CSIR-INDIAN INSTITUTE OF TOXICOLOGY RESEARCH