

Bio-fortified Varieties - Sustainable Way to Alleviate Malnutrition

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Introduction:

Personally I came to know the value of food and about the nutrients which boost our immunity during this COVID-19 pandemic. Diet which includes higher levels of vitamins and minerals, more proteins and healthier fats is utmost important these days. A quote given by Hippocrates aptly suits here that "Our food should be our medicine and our medicine should be our food ".We cannot predict when we get the vaccine for these kind of viral diseases, our food should be our medicine.

In Global hunger index report 2020, India stood at 94 out of 107 countries on the global health index. According to the report, India comes in 'serious level' category with a score of 27.2. Even the neighboring countries like Nepal, Pakistan and Bangladesh have better scores. Why India is trailing behind? When will we reach to zero hunger? In addition to hunger malnutrition is also a major problem which is also known as hidden hunger (people do not even aware of it).

What is Malnutrition?

It refers to deficiencies, excesses or imbalances in a person's intake of energy and/or nutrients. The term malnutrition covers 2 broad groups of conditions. One is 'under nutrition'- includes stunting (low height for age), wasting (low weight for height), underweight (low weight for age) and micronutrient deficiencies or insufficiencies (a lack of important vitamins and minerals). The other is over nutrition - overweight, obesity and diet-related non communicable diseases (such as heart disease, stroke, diabetes, and cancer).

Consequences of malnutrition

- Billions of people across the world eat Rice as staple food and they get satiated with their hunger. Rice adds only carbohydrates to the diet which leads to micronutrient deficiencies.
- Persistent lack of vital vitamins and minerals
- Mental retardation
- Poor health

What are all the alternatives we have now for healthy India?

- **Balanced diet** - As per ICMR recommendations 120g fruits, 300g vegetables, 300g milk, eggs, 30g pulses, 300 g carbohydrates should be taken in our diet. But it is unaffordable for many impoverished families. It is expensive to get all the foods into their plate.
- **Fortified foods and food supplements** - Food supplements like vitamin tablets and taking processed foods with all the nutrients is also an option. However, this is also expensive for poor. Adulteration of processed food have also noticed these days.

Biofortification

It is the process by which the nutritional quality of food crops is improved through agronomic practices or plant breeding or through modern biotechnology. The process do not sacrifice any character that is preferred by consumers like taste, colour and also farmers like yield, resistance. It adds nutrients at the point of production itself rather than the fortified foods are done in the processing stage which may lead to adulteration. Farmer can save the biofortified seeds and can sow for next generation there by maintaining the improved nutrition in every harvest to get vital vitamins and nutrients without the expense of distributing supplements of fortified foods.

Example Projects of Bio-fortification :

- **Iron Bio-fortification:** 528 million or 29% of women of reproductive age around the world affected by anaemia, for which approximately half would be a men able to iron supplementation. So, Increasing iron content in staple food supplements the anaemic patients. It is already done in wheat, rice, beans, sweet potato, cassava and legumes. E.g.WB02 a pure line variety of wheat has 40ppm iron in other popular varieties it has only 28-32 ppm iron.

- **Zinc Bio-fortification:** Due to zinc deficiency stunting, mental impairment and Diarrhoea in children and skin lesions are observed. So zinc content should be improved in crop varieties. Zn biofortified varieties are available in rice, wheat, maize, sweet potato and beans. E.g. DRR Dhan 45 a pure line variety of rice contains 22.6 ppm zinc in comparison with other popular varieties having only 12-16ppm.
- **Pro Vitamin A or carotenoids Bio-fortification:** Vitamin A deficiency leads to the blindness of 5 lakh children yearly and affects immune system. Pro vitamin A biofortified varieties are available in rice, sweet potato, maize, cassava. E.g. Pusa beta Kesari 1 world's first bio-fortified cauliflower. It has high beta carotene 8-10 ppm, in other popular varieties it is negligible.

Bio-fortified Varieties	Fortified Foods
Improve nutrient levels in crop during plant growth	Increase nutrient levels after harvesting and during processing
No chance of adulteration of food	May lead to Adulteration of food
E.g. High Zn variety of wheat, High Iron variety of rice	E.g. Iodised salt, Fluoride in toothpaste, Iron in flour

Benefits of Bio-fortification:

- Bio-fortified crops will have up to 3 fold increase in nutritional value.
- These bio-fortified varieties will have reduced anti nutritional factors like erucic acid in mustard, trypsin inhibitors in soyabean etc. that effect human growth and development.
- Provides sustainable and cost effective solution to alleviate malnutrition.
- These crops serve as an excellent source of balanced feed for livestock in improving their nutritional outcomes like milk.
- Bio-fortified varieties are rich in essential nutrients like iron, zinc, calcium, proteins, lysine, tryptophan, vit A and C , anthocyanin, oleic and linoleic acid.

Bio-fortification methods

- It is mainly done through SELECTIVE BREEDING.
- These programmes search for variation in the characteristic of interest for example higher iron content in the wild species.
- In selective breeding scientists use wild species, seed banks (uses seeds collected in past)and do wide crosses.
- It also done through agronomic practices and plant biotechnology without sacrificing other characteristics.

Conclusion

Bio-fortification is a food based strategy which improves nutritional status and other agronomic characteristics. It is the sustainable and cost effective way to alleviate malnutrition. It can make healthy India by targeting bio-fortification in staple food crops that not only satisfy hunger but also adds essential micronutrients to the diet.