

## Nutraceutical Value of Finger Millet [*Eleusine coracana* (L.) Gaertn.]

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The World Health Organization (WHO) recognizes that maintenance of optimum global public health requires not only prevention of early onset of chronic diseases but also promotion of a healthier aging and ultimately prolongation of life. Despite its tremendous advancement, medical science still faces a dual challenge to promote public health: side effects of medicines and their economic encumbrance. Going back to a well-recognized dogma of ancient Indian Siddha literature and Hippocrates 'food is medicine and medicine is food,' diet and dietary habits have been established to play important role for exalted health benefits based on different properties of foods. Thus, growing demand for healthier food products is stimulating innovation and development at the international scale. This research progress has advanced the emerging group of health food termed as nutraceuticals with an estimated global market of around 117 billion US Dollars. The word 'nutraceutical' was coined by Stephen DeFelice in 1989 and refers to a food or food product sold as pills, powders, or other medicinal forms to provide potential health benefits. Existing health reports suggest several physiological benefits of nutraceuticals in prevention, protection or treatment against several chronic ailments. This relationship can be visualized in day-to-day life, for example importance of calcium in preventing osteoporosis, folate in the prevention of infant neural tube defects and the role of decreasing dietary fat and increasing fiber from grains in the prevention of colon cancer etc. Thus, any significant alteration of nutrients due to improper dietary practices affects the health outcome. This area provides an opportunity for discovery and development of specific food components which can act as candidate agents for developing nutraceutical compounds. Given their health benefitting values, whole-grain cereals can be acclaimed as major nutraceutical candidates for human consumption. This review not only presents a balanced view from the perspective of biofortification of one such crop, finger millet [*Eleusine coracana* (L.) Gaertn.], possessing wholesome traits to meet global nutritional infirmity, but also explores its nascent significance as means of advancing the future of nutraceutical industry.

### Finger Millet: Magical Grain of Nutritional Importance

Finger millet belongs to the family Poaceae and is more commonly known as ragi or madua in India, rapoko in South Africa and dagusa in Ethiopia. Globally, 12% of the total millet area is under finger millet cultivation, covering more than 25 countries of Africa and Asia<sup>2</sup>. It forms a predominant staple food for people living on marginal lands and with limited economic resources. An agronomically sustainable crop, it can grow on marginal lands, high altitudes and can easily withstand drought and saline conditions, requires little irrigation and other inputs and yet maintain optimum yields.

Finger millet has been perceived as a potential "super cereal" by the United States National Academies being one of the most nutritious among all major cereals (National Research Council, 1996). From the nutritional perspective, finger millet is considerably rich in minerals and its micronutrient density is higher than that of the world's major cereal grains; rice and wheat. Specifically, it is the richest source of Calcium among cereals with up to 10-fold higher Calcium content than brown rice, wheat or maize and three times than that of milk. It is also rich in iron and fiber, making this crop more nutritive as compared to other most commonly used cereals. Finger millet is enriched in the essential amino acids like lysine and methionine which are important in human health and growth but remain absent from most other plant foods. In addition, it also contains useful amounts of the two polyunsaturated fatty acids- linoleic acid and  $\alpha$ -linolenic acid, metabolized products of which facilitate normal development of the central nervous system. It also contains both water soluble and liposoluble vitamins: thiamin, riboflavin, niacin, and tocopherols. As finger millet is often grown and consumed primarily in developing countries by small-hold farmers with limited agronomic resources, it is often referred to as a "crop for the poor" or a "famine food" (National Research Council, 1996). Despite the well-documented health benefits of finger millet, only a limited progress has been made in context to its nutraceutical applications as functional food. Although, it may have remained

underutilized by the general population due to either unawareness or apprehension, its immense potential for enhancing the nutritional and therapeutic attributes by acting as functional food cannot be ignored.

### Exploring Properties of Finger Millet for Nutraceutical Development

Recent research has shown that diets rich in plant-based foods, particularly whole-grain cereals, are protective against several degenerative diseases such as diabetes, cardiovascular diseases, few types of cancers, metabolic syndrome and Parkinson's disease. In spite of the dearth of literary evidence on role of finger millet for disease prevention, its relation to alleviate health benefits is quite substantial. It is a storehouse of salubrious properties being rich in proteins, dietary fibers, minor and major nutrients, and phytochemicals required for human health. However, these ingredients need to be isolated and developed as nutraceuticals and functional food, without disturbing the inherent functional and nutritional traits and in a cost-efficient manner.

### Conclusion

The growing demand for healthier food, effectiveness and quality of consumed product and increased public and healthcare industry awareness are the major factors that have contributed toward the formation of a nutraceutical market that is envisioned to grow many folds in coming years. The Food and Drug Administration has also released regulations that support this emerging industry therefore fostering

scientific research. Hence, an immediate goal should be identification of health benefitting factors to enhance the essential nutrient levels in staple crops to significantly impact human nutrition worldwide. Targeting of nutritionally important genes and proteins through the emerging biotechnology tools and techniques can lead to creation of 'smart' biofortified crops. Products from these value-added crops can help to cope with several problems such as protein-energy malnutrition

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