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Research Article

Nutritional and Functional Benefits of Finger Millet (*Eleusine coracana*)

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ABSTRACT

India is one of the major producers of millet crop in the world. Among small millets, finger millet occupies the largest areas under cultivation. Compare to cereals such as barley, rye and oats, finger millet is a unique due to higher nutritional contents. It is a rich source of calcium among all cereals and millets. It also have good amount of carbohydrate, fibre, protein, other minerals. The phytochemicals of finger millet makes it a functional food which can be utilized to reduce the incidence of various degenerative diseases such as diabetes, cardiovascular disease, cancers and other cognitive diseases. Though, finger millet is abundance with all these beneficial effects, its use is limited to local area where it is grown. There is an opportunity to process finger millet to produce various functional foods which can be utilized by wide population.

Key words: *Finger millet, Cereals, Nutrition, Functional*

INTRODUCTION

Millet is a general category for several species of small grained cereal crops. The most widely cultivated millets are finger millet (*Eleusine coracona*), foxtail millet (*Setariaitallica*), pearl millet (*Pennisetum typhoideum*), proso millet (*Panicum miliaceum*), barnyard millet (*Echinochooa colona*) etc. These minor millets are rich source of nutrients and minerals and resistant to drought and stress in rainfed farming. Finger millet belongs to the family Poaceae and is more commonly known as ragi or madua in India. The main constituents of the finger millet include seed coat (testa), embryo and endosperm. Numbers of varieties of finger millets such as yellow, white, tan, red, brown, or violet color are cultivated but among these only the red-colored are cultivated extensively throughout world. It is grown in India, Srilanka, Nepal, parts of Africa, Madgaskar, Malaysia, Uganda and Japan (http://agritech.tnau.ac.in). Worldwide, 12 % of the total millet area is under finger millet cultivation, in more than 25 countries of Africa and Asia[1].

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In India, finger millet is cultivated over an area of 1.19 million hectares with a production of 1.98 million tone giving an average productivity of 1661 kg per ha. Karnataka accounts for 56.21 and 59.52% of area and production of finger millet followed by Tamil Nadu (9.94% and 18.27%), Uttarakhand (9.40% and 7.76%) and Maharashtra (10.56% and 7.16%), respectively (http://www.indiastat.com). In Karnataka, finger millet is principally grown in Tumakuru, Hassan, Ramanagara, Kolar, Chikkaballapura, Mandya, Chitradurga, Bengaluru Rural, Chikkamagaluru, Mysuru, Bengaluru Urban, Chamarajnagar and

Davanagere districts. Tumakuru district accounts for 22.7 and 18.6% of of area and production of finger millet followed by Hassan (11.3% and 10.7%), Ramanagara (10.4% and 14%) and Kolar (8.3% and 9.8%), respectively (http://des.kar.nic.in). Bengaluru Urban district is having the highest productivity of 3306 kg per hectare followed by Bengaluru Rural (2,702 kg/ha). Finger millet is the chief staple food consumed by population of South Karnataka. Among all major cereals, finger millet has been perceived as a potential "super cereal" by the United States National Academies being one of the most nutritiousmillet[5]. Finger millet possess high nutritional benefits, it has thirty times more calcium than rice[6]. Although finger millet is superior compared to other cereal, it is an underutilized crops in tropical and semiarid regions of the world. There is vast scope to process millet into various value added food products in developing countries. Besides that, finger millet does not contain gluten and therefore it can be used by people with gluten allergy. There is vast potential to process millet grains into value-added foods and beverages in developing countries. Furthermore, millets, as they do not contain gluten and therefore it is advisable for stomach (abdominal) patients[7].

Nutritional Composition of finger millet

If finger millet is compared with world's major cereal; wheat and rice, it is considerably rich in micronutrients such as vitamins and minerals. Especially, it is a richest source of calcium among all major cereals with up to 10 times more calcium content than brown rice, wheat or maize and 3 times more than milk. Table 1 shows a comparative nutrient content of finger millets. If we look at the macronutrient content of finger millet, it contains 72.6 % carbohydrates, 7.3 % protein, 1.3% fat, 3.6 % crude fiber, 19.1 % dietary fiber and 3 % minerals.

Table 1: Nutrient composition of finger millets and other popular millet and cereal

Millet/ Cereal	Protein (%)	Fat (%)	Carbohydrate (%)	Crude fiber (%)	Ash (%)	Calcium (mg)	Iron (mg)	Zinc (mcg%)	Thiamin (mg%)	Riboflavin (mg%)	Niacine (mg%)
Finger millet	7.3	1.3	72.6	3.6	3	344	3.9	2.3	0.42	0.19	1.1
Pearl millet	14.5	5.1	67.5	2	2	42	11	3.1	0.38	0.21	2.8
Littele millet	7.7	4.7	67	7.6	6.9	17	9.3	3.7	0.30	0.09	3.2
Wheat	14.4	2.3	71.2	2.9	1.8	41	3.9	1	0.41	5.46	5.5
Rice	7.5	2.4	78.2	10.2	4.7	10	0.5	1.2	0.41	0.01	1.62
Maize	12.1	4.6	66.2	2.3	1.8	10	2.3	0.46	0.15	0.15	1.77
Sorghum	11	3.2	72.6	2.7	1.8	13	3.4	1.7	0.33	0.1	3.7
Barley	11.5	6.4	80.7	5.6	2.9	29	2.5	2.13	0.19	0.11	4.6

Functional Components in Finger Millet

Occurrence of Chronic diseases such as diabetes, heart disease, cognition disease and cancer in humans has been linked to oxidation of cellular molecules by reactive oxygen and nitrogen species. It is reported that several phytochemicals act as dietary antioxidants which provide defense mechanism against the oxidative damage and maintain a proper physiological balance. Due to unhealthy lifestyle, processed foods and environmental factors such as pollution, incidence of occurrence of degenerative diseases have been increasing. Therefore, in the past few years, dietary plant polyphenols have received remarkable attention for their health benefits like reduced risk of cancer, cardiovascular and neuro-degenerative diseases, infections, aging and diabetes[11,12,13]. It is reported in various studies that seed coat of finger millet grain contain high amount of various phenolic compounds which exhibit antioxidant activity. Tannins, steroids, polyphenols, alkaloids, terpenoids, cardiac glycosides and balsams, lignans, phytooestrogens, phytocyanins in finger millet act as an antioxidants, inhibitors of biological oxidation, antifungal activity, immune modulators, detoxifying agents, and protect against age-related degenerative diseases[14,15,16]. Soluble fibre in finger millet helps in lowering of plasma glucose and cholesterol, weight loss due to low calorie intake, laxative, good bowel movement, and reduction in blood cholesterol and sugar. These are untimely have a positive impact in diabetes, cardiovascular diseases, gastro-intestinal disorders, gallstones, constipation, cancer, and aging[17,18].

Tradition uses of Finger millets:

Finger millet is a staple food in some areas of Maharastra, Gujarat, and South India region. In a tribal area of South Gujarat, finger millet is a staple food which is used to prepare roti and papad. In Konkan region of Maharastra and Goa, it is used to prepare dosa, bhakhari, ambil (a sour porridge prepared with butter milk) and papad. In South Indian region, finger millet is used to prepare porridge, roti, idli, dosa, keelsa etc. But these recipes are traditional which are popular in those areas only. They are not widely popular in urban areas and other part of our country. That because of non-availability of ready to use processed food products There is a need to provide finger millet based food products in the form of ready to use grains, convenience foods or mixes to meet the demands of the present day consumers.

Value added products of Finger millet:

Many studies have been carried out for the development of value added products. Finger millet based pasta products with good cooking quality, storage stability, acceptability and higher nutritive values were developed by Devaraju *et al*.[8]. Barnyard and finger millet based *khichadi*, *laddu* and *baati* were prepared along with legumes and fenugreek seeds by Arora and Srivastava[9]. Begum *et al*.[10], carried out experiments on nutritional enhancement of common convenience foods such as *papads* by substituting conventional grains with nutritious millets. Acceptable *papads* were formulated using Finger millet (60%), sago (20%), black gram (20%) and spices. Thus, the literature reveals the millets offer wide range of opportunities for utilization in diversified products along with better nutritional qualities that

CONCLUSION

Finger millet is rich source of calcium, and other micronutrients which are limiting in popular staple cereals. It is a need to process this wonder millet to various value added food products.

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