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Finger Millet *(Eleusine coracana* L): An Integrative Review on Its Nutritional, Ethnobotanical, and Pharmacological Applications

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Abstract

Finger millet (*Eleusine coracana* L.), an ancient cereal grain, holds immense nutritional and therapeutic significance, particularly in traditional and modern dietary systems. This review compiles and evaluates available literature on its multifaceted benefits and applications. The introduction highlights the global importance of finger millet as a climate-resilient crop and a sustainable alternative to staple cereals. The nutritional composition underscores its richness in carbohydrates, dietary fiber, essential amino acids, minerals (notably calcium and iron), polyphenols, and vitamins, which contribute to its role in health promotion. Ethnobotanical uses demonstrate its long-standing application in traditional medicine and as a staple food in several cultures, where it has been employed for managing conditions such as anemia, diabetes, and gastrointestinal disorders. Pharmacological activities, including antioxidant, anti-diabetic, anti-inflammatory, antimicrobial, and cardioprotective properties, are critically reviewed with evidence from both in vitro and in vivo studies. Various processing methods such as malting, fermentation, extrusion, popping, and milling are explored for their effects on nutritional bioavailability and sensory quality. Additionally, the development of value-added products—ranging from weaning foods and bakery products to functional foods and nutraceuticals—is discussed, highlighting finger millet's potential in addressing malnutrition and lifestyle-related disorders. Collectively, this review emphasizes finger millet as a nutritionally dense and medicinally valuable grain with significant potential in health promotion, therapeutic applications, and food innovation.

Keywords: Finger millet, *Eleusine coracana*, nutritional composition, ethnobotany, pharmacological activity, processing methods, functional foods

Introduction

Finger millet, also known as ragi, has been marketed as a nutritious substitute for staple grains like wheat and rice. In several regions of Asia and Africa, it is a major source of carbohydrates and a well-known source of dietary fiber and other minerals. Since ragi is a crop that can withstand drought, it can be used to adapt to the current climate change and the conditions of diminishing water supplies in many regions of the world. However, the presence of antinutritional substances like trypsin inhibitor and alpha-amylase is the main reason why ragi is recognized to have poor digestion. (1)

Finger millet, also referred to as ragi and mandua in India, is a minor cereal that originated in Ethiopia but is now widely grown throughout India and Africa. It is a staple food that provides a significant amount of calories and protein to a large portion of the population in these countries, particularly those from low-income backgrounds. Grass species such as finger millet (Eleusine coracana (L), which are members of the monocotyledon group's Poaceae family, are considered millet crops. India is regarded as a key location for these little crops. In 2013, 762,712 metric tons of millet grains were produced worldwide, with India leading the pack with 334,500 tons produced annually, accounting for 43.85% of the total. (2)

Ragi is a nutritional powerhouse with remarkable health benefits. Ragi is a food that is perfect for individuals of all ages because of its high calcium content, which promotes bone health and prevents osteoporosis. Because of its low glycemic index, which guarantees a gradual release of glucose, it helps diabetic patients manage their blood sugar levels. Ragi's high dietary fiber content helps with digestion, avoids constipation, and benefits in weight management. It is also a great source of iron, which helps battle anemia. Ragi is beneficial for lowering cholesterol, reducing oxidative stress, and avoiding chronic diseases including heart disease and some types of cancer since it contains antioxidants like polyphenols and phytochemicals. (2)

Nutritional composition of Finger Millet

Compared to the two main cereals in the world, rice and wheat, finger millet is significantly higher in micronutrients such vitamins and minerals. The richest source of calcium is finger millet, which has three times more than milk and ten times more than rice, wheat, and maize—the comparative content of the different nutrients found in finger millets and non-millet cereals. There are 72.6% carbs, 1.3% fat, 7.3% protein, 19.1% dietary fiber, 3.6% crude fiber, and 3% minerals in finger millet, according to the statistics. It has 72.6% carbs, 1.3% fat, 7.3% protein, 19.1% dietary fiber, 3.6% crude fiber, and 3% minerals, according to finger millet.

In tropical and subtropical climates, finger millet grows well on hillsides and plains at elevations ranging from sea level to 2,300 meters. It is grown in regions with rainfall of up to 100 cm and needs very little water. The crop is primarily grown during the kharif season; however, it can be grown in both the summer and the rabi seasons.

Temperatures between 26 and 30°C foster its perfect development and yield. The crop is extremely vulnerable to frost, even if it can withstand dry circumstances. (3)

Table 1: Nutritional composition of Finger Millet

S.No	Particulars	Finger millet
1	Carbohydrate(g)	66.8
2	Protein(g)	7.2
3	Fat(g)	1.9
4	Calcium(mg)	364.0
5	Magnesium(mg)	146.0
6	Iron(mg)	4.6
7	Zinc(mg)	2.5
8	Folic acid(mg)	34.7
9	Thiamine(mg)	0.37
10	Niacin(mg)	1.3
11	Total dietary fibre (g)	11.2
12	Amino acide(%)	44.7%

Taxonomical classification (4)

Kingdom	Plantae
Clade	Angiosperms
Order	Poales
Family	Poaceae
Genus	*Eleusine*
Species	*E. coracana*

Ethnomedicinal of *Eleusine coracana*

One well-known plant in traditional medicine is Eleusine coracana. In the several areas where they are found, Eleusine coracana Linn. seeds are used to treat a variety of illnesses. Additionally, it is used to prevent anemia and cure diabetes. Additionally, it lowers triglyceride and cholesterol levels. Antioxidant, immunomodulatory, antiulcer, and anticancer properties are among its uses. *Eleusine coracana* Linn.'s seed grain is a component of the plant that is used to treat a variety of diseases in the communities where it grows. It's supposed to help with diabetic

management, osteoporosis prevention, and anaemia. It is also reported to help breastfeeding mothers who are having difficulty lactating improve their milk supply. When eaten, finger millet is said to induce relaxation and be beneficial in the treatment of anxiety, insomnia and depression. The crops are also utilised to help with weight loss, cholesterol lowering, tissue healing, and as an anti-aging agent. (5)

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Table 2: Pharmacological Activity

S. No.	Activity	Part used	Model	References
1	Antioxidant activity	Seeds	Rats	6
2	Wound healing activity	Seeds	Rats	7
3	Anti-aging activity	Seeds	Rats	8
4	Hepatoprotective activity	Seeds	Rats	9
5	Anti-cataract activity	Seeds	Cataracted Human eye lens	10
6	Anti-lithiatic activity	Seeds	Rats	11
7	Anti-microbial activity	Seeds	Microbes (*Pseudomonas aeruginosa, Klebsiella pneumonia, Salmonella* sp. etc.,) In- Silico	12
8	Anti-bacterial activity	Seeds	Pathogens (*Salmonella entrica, Bacillus subtilis, Pseudomonas aeruginosa* etc.,)	13
9	Anti-diabetic activity	Seeds	Rats	14
10	Anti-cancer activity	Seeds	cell line	15
11	Anti-nutritional activity	Seeds	Cell line	16
12	Anti-anemic activity	Powder	Adolescent High-School Girls	17
	Cardiovascular disease			18
13	Immunomodulatory activity	Seeds	Cell line	19

Several in vitro and in vivo studies (animal) have been conducted to explore the health benefits of finger millet. Production of statins (antihypercholesterolemic metabolites) from finger millet was attempted by a-Glucosidase inhibitors play a vital role in the clinical management of postprandial hyperglycemia, and established the a-glucosidase and pancreatic a-amylase inhibitory properties of finger millet phenolic extract, whereas their study indicated that finger millet phenolics are inhibitors of aldose reductase and snake venom phospholipases (PLA2). Protein glycation is one of the complications of diabetes, and protein glycation inhibitors are helpful in the management of this complication. Methanolic extracts of finger millet were found to exhibit protein glycation inhibitory properties. Animal studies on the health-beneficial aspects of finger millet feeding are also available in the literature.

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Products of finger millets

Figure 2: Traditional recipes of finger millet (ragi)

Figure 3: Ready to eat recipes of finger millet (ragi) in present era

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Various processing methods were used to create products from finger millet. (20)

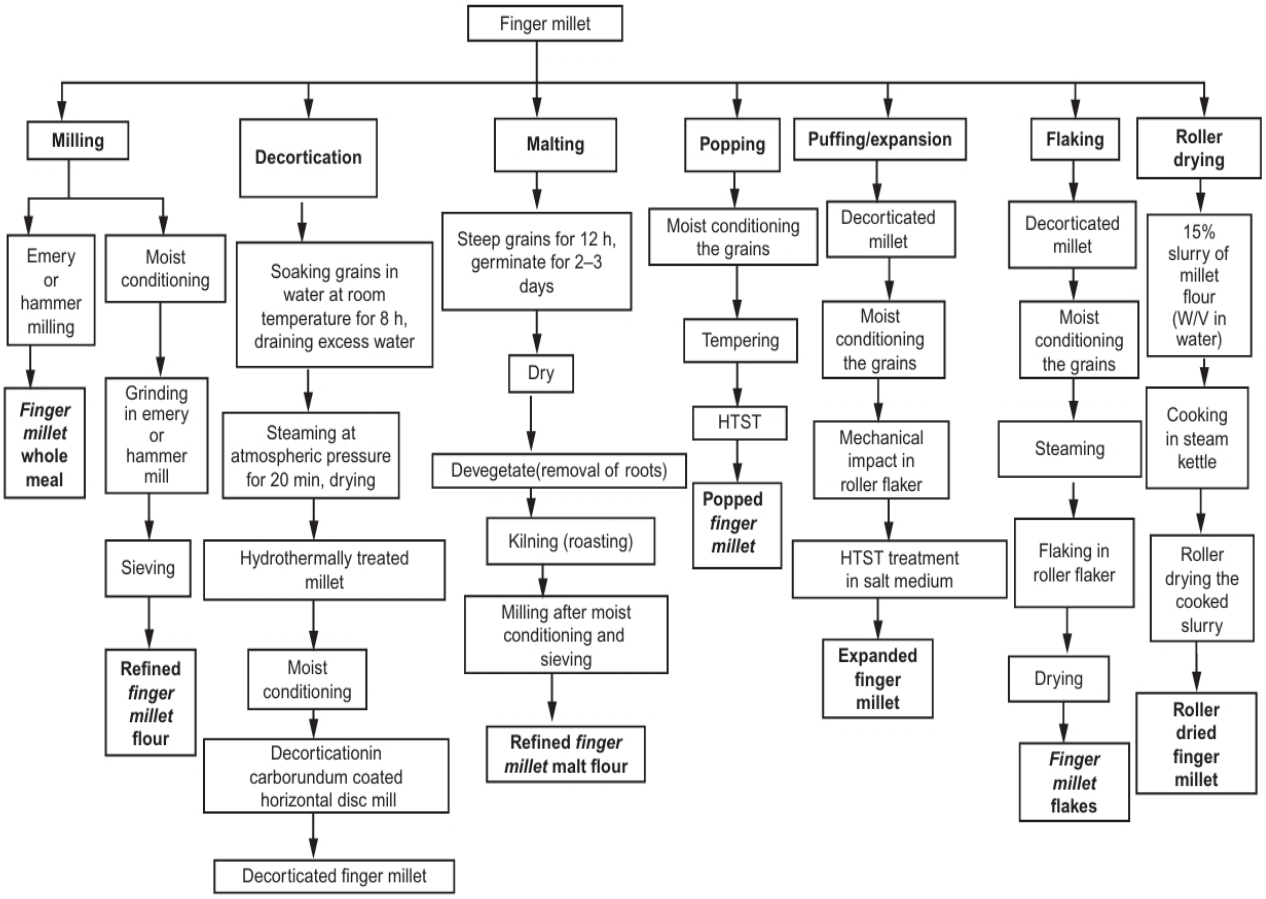

Figure 4: Various processing methods were used to create products from finger millet

Conclusion

Finger millet (*Eleusine coracana L.*) has emerged as a nutritionally superior and functionally significant cereal grain, offering multiple health-promoting attributes. Its rich composition of dietary fiber, polyphenols, essential amino acids, and micronutrients, particularly calcium and iron, highlights its value in combating malnutrition, anemia, diabetes, and lifestyle-related disorders. Ethnobotanical evidence emphasizes its longstanding use in traditional diets and medicinal practices, while modern pharmacological studies confirm its antioxidant, antidiabetic, antimicrobial, and cardioprotective activities. Processing techniques such as germination, fermentation, and malting further enhance its nutrient bioavailability and functional properties, paving the way for diversified food applications. Moreover, the development of value-added finger millet-based products demonstrates its potential in both functional

food industries and sustainable agriculture. Taken together, finger millet represents not only a staple for food security but also a therapeutic grain with immense scope for future nutraceutical and pharmaceutical exploration

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