HEALTH BENIFITS AND NUTRITIONAL CHARACTERSTICS OF FINGER MILLET (RAGI)

Abstract

The potential health benefits of phytochemicals like dietary fibre and polyphenols is supported by the increasing public knowledge of diet and health care studies. Finding fresher sources for neutraceuticals along with other natural and dietary materials with the required functional properties is therefore necessary. One of the minor grains, finger millet, has a number of health benefits, some of which are linked to the plant's high levels of dietary fibre and polyphenols. For those in lower income brackets in India, it is a staple food that is crucial. Finger millet is a significant grain that is widely cultivated in many parts of Africa and India and is an essential meal for a sizable portion of the populations in these nations. In India, it is in sixth place in terms of production, behind bajra, sorghum, wheat, and rice. It is a bare caryopsis with a seed coat the colour of brick red. Typically, it is utilised as the entire meal to prepare traditional dishes like roti, mudde (dumplings), & ambali. The nature of finger millet's nutrients and dietary fibre, as well as their significance to the health advantages of millet, are covered in this chapter.

Keywords: Health Benefits, Phytochemicals, Ragi, Neutraceuticals

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Eleusine coracana(Scientific name) is also know as finger millet or ragi. In Indiadue to its production ranks sixth after wheat,maize, rice,sorghum,and bajra has variety of names in India. Crabgrass is often referred to by different names, such as Mandua/Mangal in Hindi, ragi in kannada,telgu and hindi, Mandia (Oriya), Kezhvaragu in Tamil, Taidalu in Telangana etc .

Millet is an annual seed grain and belongs to the grass family (Poaceae). In maximum altitudes region of Asia and Africa, where it grow for it seed there height varies from 30 to 150cm. The seeds are eaten in category of form including unleave bread made from ground flour. The seed colour are brown, white, and dark brown. Variety of alcoholic beverages and porridge are also produced from the seeds of millet. Ragi was harvest about 5,000 year ago to a subspecies residing in highland from Uganda to Ethiopia . At that time, domesticated finger millet was also harvested in the lowlands of Africa.

I. NUTRITIONAL CONTENT IN FINGER MILLET

From 5 to 3.5% minerals for all grains and millet, millets has the maximum levels of potassium (408 mg%) and calcium (344 mg%). The grain is low in fat (1.3%) and contain mostly unsaturated fat. A 100 gram of finger millets have an average of about 336 kcal energy.

However, millets also contain phytate (0.48%), polyphenol, tannin (0.61%), trypsin inhibitory factor and dietary fibers, which were once consider “antinutrients” due their metal chelating and inhibitory effects on enzymes (Thompson 1993), these however today still today are referred to as nutraceuticals.Because it is non-glutinous millets, it is safest for peoples with celiac disease and gluten allergies. Its does not form acids and is therefore easily digestible. Millets is good in amino acid (threonine, tryptophan, valine, methionine and isoleucine).

II. CULTIVATION (FARMING) OF FINGER MILLET

Finger millets was domesticate about 5,000 year ago from wild sub species that lived in highland from the Ethiopia to Uganda. At that time, domesticated finger millet was also cultivated in the lowlands of Africa.

III. SOIL

Can be grow in a type of soils from good loam to poor, flat upland soils with rich organic materials. Chernozem with good drainage can also be considered for cultivation, as this cultivation is reasonably sustainable in waterlogged conditions. Finger millet grows best in soil with a pH of 4.5-8 Soils with water retention problems should not be used for growing crabgrass.

IV. LAND PREPARATION

1. **Cultivation Pattern:** When cultivating crabgrass, crop rotation is of great importance. It provides high yields, minimizes the use of chemical fertilizers and helps maintain soil

fertility. In northern India, a crop rotation of millet with chickpeas, barley, tobacco, mustard and flaxseed is simple used.

2. **Intercropping:** For Punjab soya and millet is mixed in a weight ratio of 90:100 and sowing is done. Finger millets and soybeans in Kharif & oats in Rabi are an standard and profitable forming series for the northern highlands.

For rain-fertilized crops, plow the main field deeply 2 to 3 times to keep moisture in the soils. Before sowing, a post-processing to the the multi-tine hoe and cultivator must be carried out in order to prepare a smooth seedbed. Small soil smoothing operations must be carried out before sowing, which will allow better conservation of moisture on the spot.In Uttaranchal, where frequent plowing is difficult, effective turning and digging of the soil, removing perennial weeds, and to drain excess rainwater inward slopingwith shalow drain are made.

V. SOOWING

1. **Soowing Time:** In areas of high rainfall, it can be grown as a transplant in well-drained soil. It can be grown in both rainy and irrigate condition. It grown in all growing weather in these different regions of the countries. Maximum 90% of the areas are in rainy condition and farmed during the kharif time. In Uttarakhand it usually grows in June.

2. **Spacing:** Yields above or below the optimal population decrease the yield. For optimal storage, use a spacing of 25 x 15 cm (25 cm between rows and 15 cm between plants).

3. **Soowing Depth:** Seeds should not sow deeper than 3 to 4 cm.

4. **Method for Sowing**

Sowing can be performed manually by:

- Line sowing process
- Drilling process
- Transplantation of field method
- Broadcasting

5. **Seeds**

- **Seed Rate:** For higher yield, a crop stand of 1.6 to 2 lakhs per acre and a seed rate for 4 kg/acre are optimal for sowing in the main field area. Ensure optimal crop coverage in the field by closing gaps and performing thinning work in the field.20–27 days after sowing, when the plants have already been planted in the field, when thinning out, it is necessary to remove the excess seedlings. If the plant population is not uniform, fill in the gaps with 20-25 day old seedlings as well.

- **Seed Treatment:** Soak the seeds in water (1 liter of water per kilogram of seed) for the 6 hours. Remove water and tie the seed closely in a damp bag for 2 day. Remove these seed from the wet bag after two days, they will shows signs of germinations.

Dry them in shades for two day. Use these seed for sowing process. Preferably the seed are treated with Aspergillus awamori (P-solving fungus) and Azospirillum brasilense (N-fixing bacteria) at a rate for 25 g/kg seeds. If chemical seeds treatment is to be carried out, chemically seed treatments should be completed first and then proceed to biochemical seeds treatments before sowing seed. Apply all fungicide from below

Name and amount of fungicide/insecticide (rate per kg seed)

- Thiram 4gm
- Captan 4g
- Carbendazim 2 g

VI. TRANSPLANTATION IN THE FIELD

Field transplant in areas with sufficient humidity, the method of transplanting is used. It gives a higher yield than no-till cultivation. Transplanted plants do not lie down in heavy rain.

1. **Sowing Method:** Sow seeds in May-June in a well prepared nursery. To get enough seedlings to replant 1 hectare of land, you need about 2 kg of seeds. For transplanting, use seedlings that are 3-4 week old. Before harvesting seedlings, the nursery also should be watered. Prepared slurry of 2 sachets of 300g/acre of Azospirillums inoculants in 40 litter of water and dip root portions of cotted in the solutions for 15 to 30 minutes and transplanted. Two seedling/hills are transplanted 25x8 cm and 25x10 cm apart and to a depth of 2 to 3 cm. On the third days after transplanting, the fields should be watered. If it does not rain in time, the transplanted field should be watered regularly until the seedlings are well established.

2. **Fertilizer:** Apply 5 to 10 tons of well-rotted cow manure or manure a months before sowing. Finger millet responds good to fertilizers utilisation, especially phosphate and nitrogen fertilizers. Do a soil analysis to find out the suitable fertilizer needs of your soils. If soil tests values are not present, use the 60:30:20 N: P: K ratio for rain plants. When sowing, use the full amount of P and K and half the amount of N. The left half of the N dose should be applied two or three times (30 and 50 days after sowing) depending on moisture availability control of herbs

3. **Weed Control:** In the initial stages of cultivation, weeding is necessary for good plant growth and yield. When working in rows, 2-3 operations of cultivating catch crops and weeding are required with one hand. For effective weed control use a pre-emergence herbicide such as Oxyfluorfen at 1.25kg/AC or Isoproturon at 400g/AC. For effectives post-emergence spray, weed control with 2-4-D sodium salts at a rate of 250g/acre about 20-25 days after planting.

4. **Irrigation:** Irrigation is not required as crabgrass is rainy weather crop. But during the tillering and flowering phase, when there is no rain for a long time, irrigation is necessary for good plant growth and harvests. The furrows and heaps prepared for irrigation are used for both drainage and irrigation.

These crops cannot withstand in water load condition, there for supervision should be taken for whole removal of extra water.

No. of Irrigations	Irrigation Time Gap
1st irrigations	Immediate after sowings
2nd irrigations	On 3rd day after sowings
3rd irrigations	On 7th day after sowings
4th irrigations	On 12th day of sowings
5th irrigations	On 18 th day of sowings

VII. PROTECTIONS OF PLANTS

Pest and Controls

1. **Army Worm and Owl Worm**: Appeared at the beginning of the cultivation phase. Cut off the based of the caterpillar plant at the beginning of cultivation. They are actively day and night, hiding in crevices and under rocks. These are cyclic

   Control: Prevent worm egg, released the parasitoidd Trichogramma on the 3rd floor once a week. Uninterrupted weeks, if symptoms are noted apply malathion 5% at 10kg/week or chinalphos 1.5% at 250ml/week. Remove weeds and stubble after harvest.

2. **Aphids:** Present throughout the growing season. They can be observed at the mid-spiral and at the tips. When infested with aphids, yellowing of the leaves can be observed. Aphid nymph is round in shapes and reddish-brown colors. Adult is yellow with green legs. Control if an infestations are observe, control by spraying Methyldemeton 25EC at 80ml/acre or Dimethoate 30EC at 200ml/acre mix in 100L of water.

3. **White Stem Borers:** The larvae is located in the bottom part of the stem and cause degradation They grow on the roots and if the infestation is severe, the central shoot dry out and turn yellow color. The larva are milky white and yellow color head, while the adult is dark brown-white on the forewing.

   Control: If infestations are observe, spray Carabaryl 50WP at 1kg/acre and dimethoate are 30 EC at 200ml in 100L of water.

4. **Ear Head Bug:** The adult animals infest the cultures in the milk stage. They feed on the emerging cobs of corn and form paillettes of silky cobwebs. The eggs are glossy white and lie in clusters with orange hair. The caterpillar is brown with a yellow color stripe and fine hair. Adult is brown in color with fibrou forewing and yellowish hind wing.

   Control: Light traps should be set up during the day to attract adult moths. Place a pheromone trap at a distance of 5/hectare from flower to panicle level. In cases of heavy infestations, spray 400 ml of malathion or 600 g carbaryl with 100 l water per hectare.

5. **Grass Hopper:** The adults and nymphs feed on leave. Nymph is white in color and line while adult is greenish-brown color with line on the body.

Inspection: After harvest, removes whole plant debris and ensure fully hygiene and cleanling in the fields. In the summer, also plow after harvest so that the eggs in the soil are expose to the sun and then destroye. In dryed and wet condition, use Entomophthora gryllis to controled locusts. If infestation are observe, spray the Carbaryl 50 WP@600 g/acre.

6. **Leaf Folders:** The leaf fold lengthwise and the larvas stays insides. They rub against the leave and then white spots are observe on the leave. The female lay 200 eggs on the both sides of the leaf. The egg is yellowish & white. The larva is greenish & yellow with a brown and black heads. The pupae are dark browns and are located in the folded leafs, while the adult is whitish-yellow and golden yellow color.

   Control: Crop rotation with non-cereal crop and keep the pitch and the area around the pitch cleans. Avoid nearest spacing when planting. Destroyed and collect infected leafs and plant part away from field. Spray Quinalphos@2.5ml or Chlorpyriphos@2.5ml or Acephate@1gm or Cartap Hydrochloride@2gm/Ltr or Carbaryl@1gm.

7. **Disease and control**

- **Blast:** If the contamination is severe, the plants appears infested or burned, and deposits from the crop are visible. This happened mainly during the kharif season in all stages of growth. If downy mildew occurs during the rearing phase or during the ear development phase, a significant drop in yield can be observed.

- **Control:** Breeds cultivars resistant to late blight. Before sowing, treat the seeds with a carbendazim-type fungicide at a dose of 2 g/kg.If the infestation is severe, the entire plant will turn yellow. Infect plant produces maximum nodal branche and unproductives shoots.

  If symptom is asses, uproots and remove infection plants and destroy outside the area. Prepare Methyl demeton @ 25EC 200ml/Acro-Spray. If necessary, spray the second spray every 20 days.

VIII. HARVESTING

Plants typically mature in 120–135 days, this time may vary depending on strain usage. The harevesting is two way procedure The cobs are produced with a sickle and the straws are removed near to the floor. The earmuff is bought and then dried in the sun for 3-4 days. After a sufficient dehydration period, the harvesting begins. In many area the complete plants, including the brambles, is harvested , dug up and dried in the sun for two to three day, and threshed.

Post Harvest: Finger millets malt are a traditional method used in India and used in the preparation of baby formula and the thickening of milk, ordinary called ragi malt, and use in the process of milk beverage. In some parts of the country, the grain is also used to make a fermented drink or beer.

IX. FINGER MILLET PRODUCTION (COUNTRY/STATE)

Finger millet, also called Ragi, is grown in Africa, India, Nepal and many Asian countries. It is important millet that is widely grown in different parts of India and Africa.

In India, finger millet (cranberry) is mainly grow and utilized in Karnataka and to a lesser area in Andhra Pradesh, Odisha, Tamil Nadu, Maharashtra, Goa and Uttarakhand.

Important for small farmers as it can be used in catch crop systems (with corn, sorghum and/or legumes) to generate additional income. Produces reasonable yields in low-input farming systems. It can survive in poor soil. Countries producing finger millet include:

1. India
2. China
3. Mali
4. Burkina Fas
5. Sudan
6. Ethiopia
7. Chad
8. Sengea
9. Nigeria
10. Niger

X. FINGER MILLETS HEALTH BENIFITS

Finger Millets are a rich sources of natural calcium, which strengthen bones in children growth and the elderly. Excessive use of millet is good for bone health, prevents problem like osteoporosis, and may decrease the chances of fractures.

Facors like polyphenols,phylates, and tannis acts as antioxidants and play important role in health, metabolic diseases and aging.

The phytochemicals in finger millets help to slow down the digestive process.Helps control blood sugar levels in diabetics. The millet finger diet controls diabetics because it has more fiber than wheat and rice. The study also found that a whole millet had a lower glycemic response; H. a reduced capacity to raise blood sugar levels. This happen due to the availability of property of ragi flour that reduce starch absorption and digestibility.

Due to this good nutritional content, finger millet flour is recommended like food for young children, mainly in southern India.

Millet is an excellent store of natural iron and its utilization help treat disease like anemia. Millet foods are very suitable for pregnant women and the elderly due to their maximum iron content and calcium.

Consuming crabgrass naturally help to relax the body. It has a positive effect on anxiety, insomnia and depression. These are also helpful for migraines.

Green finger millet are used for high liver disease, blood pressure, heart failure and asthma. Green finger millet is also recommended for breastfeeding mother with milk deficiency.

Regular consumption of crabgrass can help prevent malnutrition, premature skin aging and degenerative diseases.

Ragi is also a rich source of iron. 100 g Ragi contain 3.2 mg iron. Since iron deficiency in the body causes anemia, adding ragi foods to the diet helps cure anemia Millet is therefore an exceptionally nutritious grain and very conducive to maintaining good health. Therefore, attention has been drawn to their potential role as functional foods. Millet can be consumed in various forms and dishes. Ragi dosa, rice, porridge, upma, cakes and biscuits are favourable millet (ragi) dishes.

Daily consumption of raga in controlled portions helps improve the transmission of nerve impulses, activate memory centers in the brain and relax the mind by increasing levels of the amino acid tryptophan. Because tryptophan balances levels of the neurotransmitter serotonin, ragi helps treat anxiety and insomnia, boosts mood, and promotes sound sleep.

IBS refers to Irritable Bowel Syndrome, a common bowel disorder that causes excruciating pain as well as abnormal bowel movements, diarrhea, bloating, and constipation.

Ragi is packed with beneficial fiber in greater amounts than many other grains like wheat, barley, and oats. Eating foods high in fiber has a positive effect on intestinal peristalsis, regulates stool volume and promotes the optimal passage of food and other substances through the intestine. So, eating an oatmeal ragi meal for breakfast stimulates a healthy metabolism, relieves symptoms of irritable bowel syndrome, and even helps prevent the risk of colon cancer.

XI. DISADVANTAGES OF FINGER MILLETS

Its high consumption and amount of oxalic acid in the body is directly proptional to eac other. Therefore kidney stones (urolithiasis) patient are advice to reduce its intake. Millet is gaining popularity due to its many benefits, but the nutritionist points out that the phytic acid it contains can reduce the absorption of other nutrients. Also, it can be uncomfortable for some people's gut health. Anupama Menon is on the way to incorporating millet into her diet.

The glycosides contained in Ragi can easily be converted to thiocyanate by enzymes when ingested. This thiocyanate has been linked to goiter in a population that regularly consumes millet and cassava. Consuming Ragi is believed to negatively affect thyroid and pancreas function. Therefore, it can stunt growth. Ragi can also cause pathological changes in the liver.

Excessive consumption of Ragi foods can increase potassium levels in the body. This can lead to problems like tingling, nausea, and chest pain.

