

ROLE OF MILLETS

IN ENSURING NUTRITIONAL SECURITY AND IN SUSTAINABILITY AND ITS BENEFITS FOR HUMAN HEALTH

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INTRODUCTION

Recent developments in science and technology have modernized the agriculture and the production of food grains is increased by several folds. The world total cereal grain production was 2719 million tonnes in 2018-19 and that was enough to feed world population. But on the contrary, the resources are being exploited and the over production is resulting in nutrient deficient soils. According to a report of International Crop Research Institutes on the Semi-Arid Tropics (ICRISAT) 6.5 million hectares of dryland area and due to climate change this area has been increased by 10 percent. We can no longer exploit the fertile soils as the overproduction has reduced the nutrient density of cereal grains. We need to look for alternate cereals and try to make our drylands productive.

Milletts possess a huge potential to solve this problem as they have the ability to grow on poor soils, require less irrigation and are possess better nutritional properties in comparison to rice and wheat. The millets are also known as famine grain owing to their productivity under extreme conditions and resistance to pests and diseases. These cereals

also requires micro-dosing of fertilizers when compared to major cereals like rice and wheat. Millets constitute the staple diet in many parts of Asia and Africa since ancient time. Millets are also rich in phytochemicals and possess several health benefits such as lowering blood glucose level, reduces chances of tumor development, lowers the cholesterol and reduces cardiovascular diseases. Strong antioxidant properties of millets help in the prevention of cancer.

Milletts are a group of highly variable small seeded grasses, widely grown around the world as cereal crops or grains for fodder and human food. They do not form a taxonomic group, but rather a functional or agronomic one. Millets are important crops in the semi-arid tropics of Asia and Africa (especially in India and Nigeria), with 97% of millet production in developing countries. The crop is favored: due to its productivity and short growing season under dry, high-temperature conditions. The most widely grown millet is pearl millet, which is an important crop in India and parts of Africa. Finger millet, Proso millet, and Foxtail millet are also important crop species. In the developed world, millets are less important. For example, in the United States only Proso millet is significant, and it is mostly grown for bird seed.

Chart 1. Millets: an approach for sustainable agriculture and healthy world

Food Security	Nutritional Security	Safety from diseases	Economic security
Sustainable food source for combating hunger in changing world climate	Rich in micronutrients like calcium, iron, zinc, iodine etc.	Gluten free: a substitute for wheat in celiac diseases	Climate resilient crop
Resistant to climate stress, pests and diseases	Rich in bioactive compounds	Low GI: a good food for diabetic persons	Sustainable income source for farmers
	Better amino acid profile	Can help to combat cardiovascular diseases, anemia, calcium deficiency etc.	Low investment needed for production
			Value addition can lead to economic gains

While millets are indigenous to many parts of the world, it is believed that they had an evolutionary origin in tropical western Africa, as that is where the greatest number of both wild and cultivated forms exist. Millets have been important food staples in human history, particularly in Asia and Africa. They have been in cultivation in East Asia for the last 10,000 years.

It is mainly known as ragi in India but various other local names like koda, mandal are also prevalent in the different parts of the country. It has high nutritional value and phytochemical content which makes it a super cereal which can be used for the development of functional foods. It is a good source of proteins and has well balanced amino acid profile.

MAJOR MILLETS

1. Pearl millet

Pearl millet (*Pennisetum glaucum*) is native to Africa and is widely grown in India. Earlier, it was used as a forage crop but was later (4000 to 5000 years ago) adopted as a food crop. Presently, it has been cultivated across Africa and Asia and is known by various common names like Bulrush millet, Amabele, Bajra. It can be grown on low fertile soils with a low rainfall of 200-600 mm.

2. Finger millet

Finger millet (*Eleusine coracana*) is considered to be originated in Ethiopia and is believed to be introduced in India about 4000 years ago.

3. Proso millet

Proso Millet (*Panicum miliaceum*) is also known as common millet, hog millet, broom millet, yellow hog, black seed proso millet and white millet. It is native to Manchuria and was introduced to Europe and India about 3000 years ago. It can grow in many soil and climatic conditions. It grows well from 1200 meters to 3500 meters. It has a short maturing time of 60-90 days. Nutritionally, proso millet is comparable to wheat.

4. Foxtail millet

Foxtail millet (*Setaria italica*) is native to China. It is considered the first domesticated millet and its cultivation was started about 7000 years ago. Other names like foxtail bristlegrass, Italian foxtail, Italian millet,

German millet and Siberian millet are also prevalent for this millet. It likes cold draughtier regions. It is cultivated in an altitude range of sea level to 2000 meters.

5. Barnyard millet

Barnyard millet was derived from wild millet barnyardgrass (*Echinochloa crusgalli*) and was domesticated about 4000 years ago in India and Japan. There are two species of barnyard millet i.e., *E. frumentacea* (Indian barnyard millet) and *E. esculenta* (Japanese barnyard millet). It is cultivated mainly in India, China and Japan as a substitute for rice and is known with various names like Japanese millet, white millet, black millet, alkali millet, water grass, duck millet. It is the fastest growing of all the millets.

NUTRITIONAL IMPORTANCE OF MILLETS



Sorghum and millets namely, Pearl millet, Finger millet, Kodo millet, Proso millet, Foxtail millet, Little millet, and Barnyard millet are important staples to millions of people world-wide. Generally, these are rain fed crops grown in areas with low rainfall and thus assume greater importance for sustained agriculture and food security. Almost all the millets are used for human consumption in most of the developing countries but their use has been primarily restricted to animal feed in developed countries. Millets are nutritionally comparable to major cereals and serve as a good source of protein, micronutrients and phytochemicals.

While sorghum and most of the millets contain about 10% protein, 3.5% lipids, finger millet contains 12-16% protein and 2-5% lipids. Sorghum and millets are very good sources of micronutrients such as vitamins and minerals. Major portion of sorghum protein is prolamins (kaffirin) which has a unique feature of lowering digestibility upon cooking whereas, the millets have a better amino acid profile. It has been reported that sorghum proteins upon cooking are significantly less digestible than other cereal proteins, which might be a health benefit for certain dietary groups. On the other hand, millets contain fewer cross-linked prolamins, which may be an additional factor contributing to higher digestibility of the millet proteins.

NUTRITIONAL PROFILE

Like most cereals, millets are starchy grains — meaning that they're rich in carbs. Notably, they also pack several vitamins and minerals.

One cup (174 grams) of cooked millet packs:

- ✓ Calories: 207
- ✓ Carbs: 41 grams
- ✓ Fiber: 2.2 grams
- ✓ Protein: 6 grams
- ✓ Fat: 1.7 grams
- ✓ Phosphorus: 25% of the Daily Value (DV)
- ✓ Magnesium: 19% of the DV
- ✓ Iron: 6% of the DV

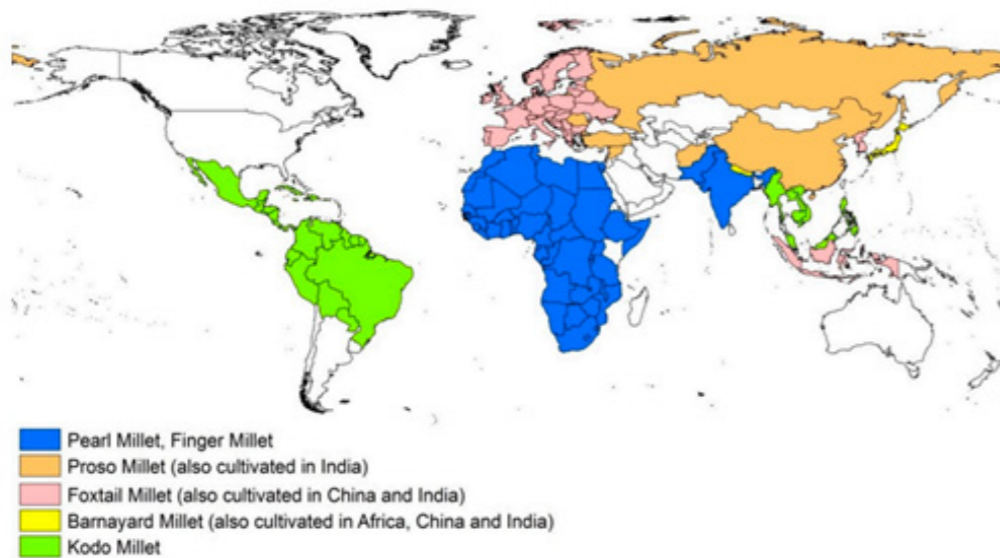


Fig. 1. Cultivation of different types of millets around the world

HEALTH BENEFITS OF MILLETS

Millets have potential health benefits and epidemiological studies have showed that consumption of millets reduces risk of heart disease, protects from diabetes, improves digestive system, lowers the risk of cancer, detoxifies the body, increases immunity in respiratory health, increases energy levels and improves muscular and neural systems and are protective against several degenerative diseases such as metabolic syndrome and Parkinson's disease.

1. Cardiovascular Diseases

Being rich sources of magnesium, millets help in reducing blood pressure and risk of heart strokes especially in atherosclerosis. Also, the potassium present in millets helps in keeping blood pressure low by acting as a vasodilator and help to reduce cardiovascular risk. Also, the plant lignans present in millets have the ability to convert into animal lignans in presence of microflora in digestive system and protect against certain cancers and heart disease. The high fiber present in millets plays a major role in cholesterol lowering eliminating LDL from the system and increasing the effects of HDL.

- ✿ Pearl Millet: The lignin and phytonutrients in millet act as strong antioxidants thus preventing heart related diseases. This is why, pearl millet is considered good for heart health.
- ✿ Finger Millet: The finger millets and proso millets have also shown to lower significantly the concentrations of serum triglycerides than white rice and sorghum fed rats. Finger millet and proso millet may prevent cardiovascular disease by reducing plasma triglycerides in hyperlipidemic rats.

2. Diabetes Mellitus

Diabetes mellitus is a chronic metabolic disorder characterized by hyperglycemia with alterations in carbohydrate, protein, and lipid metabolism. It is considered as the most common endocrine disorder and results in deficient insulin production (type 1) or combined resistance to insulin action and the insulin-secretory response (type 2). The efficiency of insulin and glucose receptors in the body is increased by the significant levels of magnesium content present in millets and help in preventing diabetes.

- ✿ Sorghum: It contains slow digestible starch (SDS) in good amounts, which has functional property, prolongs digestion and absorption of carbohydrates in intestine. This SDS is favorable for dietary management and also for metabolic disorders such as diabetes and hyperlipidemia. Sorghum is rich in dietary fiber and low glycemic index, which could help in prevention and control of T2D in Indians.

