

Millets

Panacea for Future Multiple Securities

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Millets offer nutritional securities and thus it is high time for promoting the millets as they are highly nutritious. These millets are the main staples food in human civilization, especially in Asia and Africa. Food, nutritional, fodder, health, environmental, and livelihood security are all major sources that is provided by a single crop i.e. millet. Millets are treasure troves of nutrients and are nutritionally superior to rice, wheat and maize in terms of protein, essential amino acids, minerals and vitamins. Advantages of millets cultivation include abiotic and biotic stress tolerant, short-duration, labour efficient and low price input. It can fit well in all cropping systems under aberrant weather conditions. It improves the immune system, prevents anemia/cancer, improve digestive system, and reduce the blood sugar level and heart problem. These characters make millets as climate resilient crops and it has wider scope over cereals crop for future multiple securities.

Key words: Health benefit, Millets, Millet processing, Nutritional security

MILLET is a major staples food for the rainfed region. In India, millet is cultivating in ~17 mha with productions of 18 mt and contributes ~10% to country food grains. This crop is are nutri-cereals, more nutritious and well-known to have a higher nutrient content i.e. protein, essential fatty acid, dietary-fibers, vitamins, and minerals like calcium, iron, zinc, potassium and magnesium. Millet has several health benefits i.e. lowering in blood sugar levels (diabe-tic), blood pressures regulation, thyroids and cardio-vascular diseases. On the other hand, direct uses of millet in food habit declined remarkably over the past three decade in the country. The reasons in decline of millet use are lacking awareness of nutritional merit, difficulty in cooking, lack of processing techniques, and disincentive government policies toward millet and support of supplying cereals at subsidize rates. It has become imperative to reorient efforts on nutri-cereals to generating the demand through value-addition of food through diversification of

processing techniques, nutrition profiling, and creations of awareness by backward integration. It is imperative to explore the approach for creating consciousness on the nutrition merit of millet.

India was the largest producer of millet during 2000-2009. Altogether 08 millet species (jowar, bajra,ragi, kauni, kodo, proso, barnyard and little millet) are cultivated in the rainfed conditions in the country. Further, in each millet producing area, at least 4-5 spp. are cultivated as a main/allied crop with pulses/oilseeds crops. For example, bajra and jowar are grown as main as well as allied crops in the desert regions. Likewise, jowar is taken as the main crop in Telangana, Andhra Pradesh, and Maharashtra, while considered as fodders in part of Southern states of the country. Main nutrient present in nutri-cereals include starches, oligo-saccharides, lipid, and antioxidant i.e. phenolic acid, flavonoid, lignin, phytosterols are believed to be responsible for many health benefit.

Major cereals crop i.e. rice and wheat provide simply food securities,

while millet can provide multiple securities i.e. food, fodders, health, nutrition, livelihood and environment. Millets crop includes small seeded grasses which have high adaptability to different climatic conditions. On basis of grain sizes, millet crops have been group into major millet, which includes jowar and bajra and many small grain-millet that includes ragi, kangni, proso-millet (cheena), kodo-millet (kodo), little millet (kutki) and barnyard millet (sawan). Among the millets, pearl-millet contributes ~95% of production. Millets are a staple food of rural and poor people and also as animal feed. Most of the millets have edible stalks, which are favoured fodder for cattle. Millets are a treasure trove of nutrients as compare to rice, wheat and maize as it is superior in terms of nutritive values i.e. protein, dietary fibers, Fe, Zn, Ca, P, K, vitamins, and essentials amino acids. But the presence of anti-nutrients i.e. phytates, polyphenol, and tannin reduces mineral bio-availability by chelating multivalent cations i.e. Fe^{2+} , Zn^{2+} , Ca^{2+} , Mg^{2+} and K^{+} .

There are many benefits of millet cultivation, which includes abiotic (drought, temperature and salinity) and biotic (pest and disease) stress tolerant, short duration, labour efficient and low price input. Few insect-pests attract millets, therefore, very little amount of pesticides are required to manage the insect-pest, so it is termed as pest-free crops. Therefore, growing of these crops has a greater fortunate thing in agricultural production system. Millet crops are C4-plant and thus, they absorb more carbon and thereby reduce Greenhouse gases. All these attributes of the millet-based cropping system make them a perfect

candidate for climate-resilient crops. Thus, we need have crops which can withstand adverse climatic change and fit well into any cropping system, that crop could be millets.

Possible reasons for less popularization of millet crops

- Lacking technical-knowledge amongst the farming community and processors in regards to the processing as compared to the existing traditional old aged method.
- Coupled with cultural issues in adoptions and diversifications of food habits.
- Lacking awareness amongst public

domain in nutritional profiling of the millet crops and also common opinions that millet crops are mostly defined to poor men crop.

- Reluctance among consumers to buy and consumer.

Health benefits of small millets

- Assist in lowering blood sugars levels, when consumed on regular basis.
- Lowering triglyceride levels, and increase in cholesterol.
- Lowering the glycemic index.
- Gradual increases in blood sugar levels after food intakes compared to rice.
- Best foods for people anguished

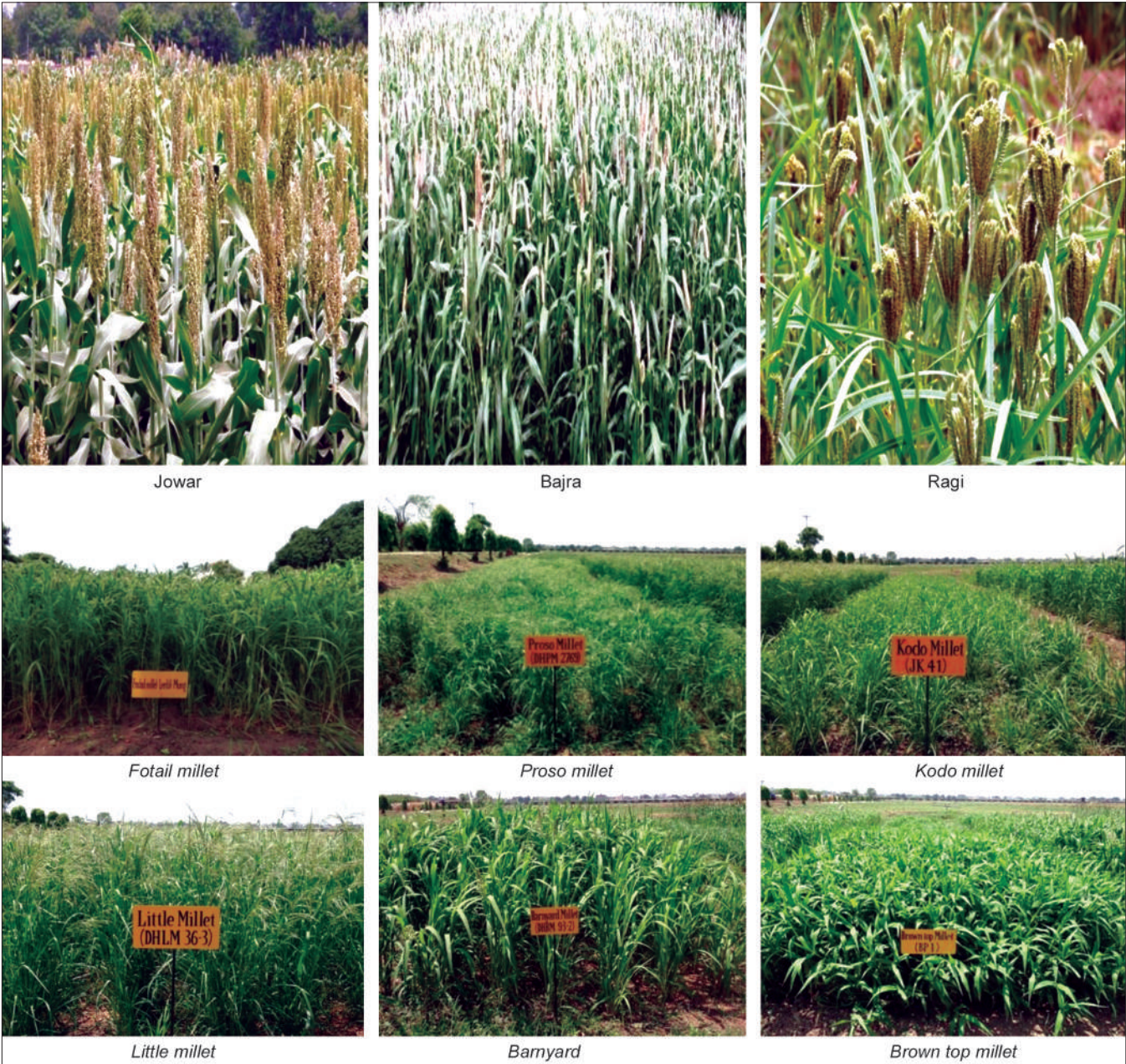


Fig. 1. Millet species cultivated in the rainfed condition

from diabetics and gastric problems.

- Reduces the risk of heart attack.
- Helps in the expansion of body tissues and energy metabolism.
- Rich in anti-oxidants and alkaloids.

Nutritional profile of millets

Comparing nutritional profiling of the millet with rice, wheat and maize, it can be concluded that millet is miles ahead (Table 1). Among the millets, bajra has the higher nutrient *viz.* zinc, Fe, P, Mg, riboflavin and folic acid and ragi has extraordinary content of Ca than any other cereals. Nowadays, World population is facing a major challenge to combating the hidden hunger and doctor is prescribing pills/capsules of these micronutrient. Millets have innate quantities of micronutrients, so eating millet reduce the dependency on pills/capsules. Each one of millet has more fibers compared to rice, wheat and maize. Cereals have less/no fibers, which are very essential for all living beings. In this scenario, millet crops are better options compared to cereal crops, thus cultivation of millet crops could be a sustainable approach to provide multiple securities to the farming community.

Millet-grain contains ~65% carbohydrates, a higher proportion in the form of non-starchy polysaccharides and dietary fibers that help in the prevention of constipation; lowering down blood cholesterol and slow releases of glucose to bloodstream, while digestion. Lowering rate of cardiovascular diseases and diabetes are noted among usual millets users. Millet grain is richer in thiamine,

riboflavin, folic acid and niacin. It varies in the content of carbohydrates i.e. amylose and amylopectin from 16-28 and 72-84%, respectively. The nutrient composition of millet grain indicates that it is a good source of energy, protein, vitamins and minerals including micro-nutrient. Edible component of millet grain is rich in phytochemicals i.e. dietary fiber/polyphenol (0.2-0.3%). It also contributes to anti-oxidant activities with phytate, polyphenols and tannins present in it. Highest Ca content is present in finger millet with 344 mg/100g among cereals.

Health benefit

Jowar, bajra, ragi, kodo millet, proso millet, kauni, little and barnyard millet are important staples to millions of people worldwide. Generally, these are rainfed crops grown in areas with low rainfall, thus resumes greater importance for sustainable agriculture for food security. Almost all the millets are useful for human food habits in most of the developing countries, but their use has primarily been restricted to animal feed in developed countries. Processing methods like soaking, malting, decortication, and cooking affect anti-oxidant content and activity. While jowar and most millet contain ~10% protein, 3.5% lipids, finger millet contains 12-16% protein and 2-5% lipids. A major portion of jowar protein is prolamins (kaffirin), which has an exclusive trait of lower digestibility upon cooking whereas, minor millet has a superior amino acid profiling. Among the millet, bajra contain a considerably high proportion of proteins (12-16%) as well as lipids (4-6%) whereas; ragi

had a lower level of protein (6-8%) and fat (1.5-2%). Essential amino acid profiles of millets protein are better compared to maize. Niacin content in bajra is higher, whereas, ragi protein is sole as it is rich in S containing amino acids.

Millets has been found with a pack of benefits toward maintaining good health. It has less calorie count so a person who is conscious about their body weight or want to lose their body weight that person can eat millet. Low calorie count help a person to feel energetic without feeling hunger. It is a rich source of iron as well as folate and folic acid, which prevent anemia by supporting the formation of red blood cells (RBC) and maintain an adequate hemoglobin levels. P content of millet helps in the formation of cells, tissue and body growth and development. It has a high amount of essential amino acids, which improves the nervous system. It has a low glycemic index so, it helps in reducing blood glucose levels and important food for diabetic patient. Due to containing high fiber, it helps in the digestion of food and reducing cholesterol levels in the body. Free radicals are toxic products of metabolism, cause many health abnormality. Antioxidant present in millets neutralizes the free radicals and so it prevents the onset of cancer and age-related disease. Millet contains essential fatty acids. This prevents the extra deposition of fat in the body and reduces cholesterol as a result chance of heart-related problem decreases.

Millet processing

Whole grain provides a wider range of nutrients and phytochemicals that optimizes health

Table 1. Nutritive values of millets and cereals per 100 g

Nutritive values	Millet crops					Cereal crops				
	Jowar	Bajra	Ragi	Kodo millet	Fox tail millet	Barnyard millet	Proso millet	Wheat-flour	Rice-milled	Maize
Ca (mg)	25.0	42.0	344	27.0	31.0	20.0	17.0	48.0	10.0	10.0
Fat (g)	1.9	5.0	1.3	1.4	4.3	2.2	4.7	1.7	0.4	3.6
Protein (g)	10.4	11.6	7.3	8.3	12.3	6.2	7.7	12.1	6.8	11.1
Zn (mg)	1.6	3.1	2.3	0.7	2.4	3.0	3.7	2.2	1.4	2.8
Fe (mg)	4.1	8.0	3.9	0.5	2.8	5.0	9.3	4.9	3.2	2.3
Fibre (g)	1.6	1.2	3.6	9.0	8.0	9.8	7.6	1.2	0.2	2.7
Riboflavin (mg)	0.13	0.25	0.19	0.09	0.11	0.10	0.01	0.17	0.06	0.1
Folic acid (mg)	20	45.5	18.3	23.1	15.0	-	9.0	36.6	8.0	20
Thiamine (mg)	0.37	0.33	0.42	0.33	0.59	0.33	0.21	0.42	0.06	0.42

Source: Adopted from Gopalan *et al.*1989

issues. Epidemiologic studies support the protectiveness of wholegrain use for cardiovascular disease. Dietician guidance endorses increased wholegrain consumption in diets. The processing is habitually believed to have negative attributes from the nutrition point of view, and some kind of processing reduces nutritive value. Various factors support the importance of the processing of grain to enhance grain uses. First, whole-grain after harvesting is not commonly used directly but needs processing prior to uses. While refining, that is removal of bran/germ, reduces nutritive values of grains, grain milling removes poorly digested compounds. Cooked grain increases the digestibility of nutrient and phytochemical. Processing involves partial separation/modification of the main constituent of the cereal grain-germ, starch-containing endosperm and protective peri-carp. Various old aged practices of processing are widely used in semi-arid tropics, whereas the small millet is grown mainly for human uses. Most of these techniques are labour intensive and carried out manually and left for women to do. Some extent methods that are urbanized to make customary food to suits local taste. Traditional techniques commonly include decorticating (pounding/winnowing), malting, fermentation, roasting, flaking and grinding. Millet has extraordinary nutrient profile compared to rice, wheat and maize even bio-availability of these nutrients are very low due to presence of anti-nutritional factor *viz.* phytate, polyphenol and tannin. Several processed methods of millets grain e.g. milling, roasting, soaking, popping, malting, blanching, acid treatment, germination and fermentation had been noted to decrease these anti-nutritional factors. Milling of millet grain, roasting and soaking of millet flour can increase the level of phytate degrading enzyme (phytases) as a result bio-availability of Fe/Zn increases. Malting can decrease tannin content while fermentation and germination can increase vitamins content *viz.* niacine, thiamine, riboflavin. Popping of grain increases the digestion of

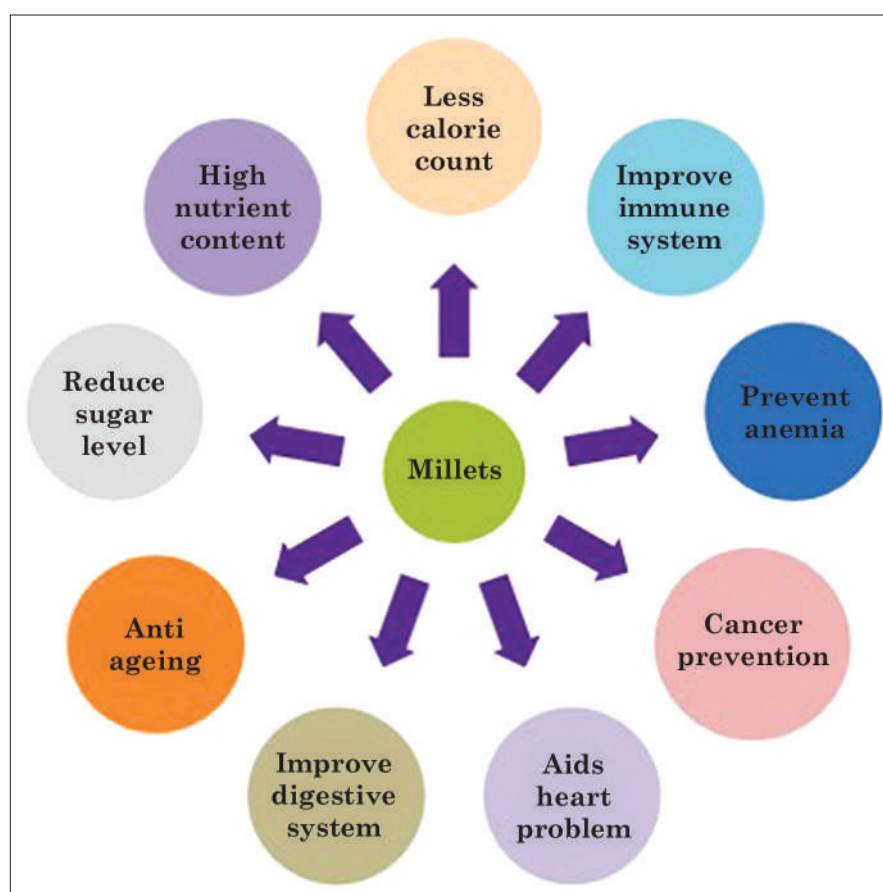


Fig. 2. Various health benefits of millet.

protein and carbohydrates. Huge products are prepared from millets processing and this can help in income generation for the farming community.

Industrial uses

Millet crops are incomparable to the main cereal crops in terms of nutritive values, also a good source of nutraceutical properties. Processing of millets grain for various end user involving primary (wetting, dehulling, milling) and secondary (fermentation, malting, extrusion, flaking, popping, roasting) operation. Being a staple and consumption at the household level, processing must be judged at the traditional and industrial level, involving the small to large-scale entrepreneurs. Dehulling is unfavourable to millet due to small grains size and nutrient losses. All millet can be milled by manually grinding at households or machine milling i.e. cottage, small to medium scale service and large scale industrial. Most important uses of millet as industrial raw materials include the production of biscuits, beverages,

weaning food and beers. Grits, multi-grain flours, meals from cereals i.e. jowar, bajra and ragi are present in market.

SUMMARY

Considering the nutritive values, millets offer alternate resilient crops in existing cropping systems to widen food baskets to ensure the multiple securities like food, nutrition, fodder, fibre, health, livelihood and cleaner and safer environments. Commercializations of the products have extended for other millet too. Though millet food product is known for nutrition, its awareness among consumers is scanty especially on nutritional and therapeutic values. Thus, implementations of efficient supportive strategies and policies sensitized entrepreneurs should be on priority.

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