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Millet- the Frugal Grain

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ABSTRACT

Millet is widely used to refer to a variety of grains that are very popular for their culinary uses as well as their health promoting qualities. Millet is one of the oldest foods known to humans and possibly the first cereal grain to be used for domestic purposes. Millet grain is the basic foodstuff for farm households in the world's poorest countries and among the poorest people. Today, millet ranks as the sixth most important grain in the world. Millets being less expensive compared to other cereals and the staple for poorer section of the population. Fortification of millets is a cost-effective method that can be exploiting the deficiency and it is a feasible strategy to enhance the intake of fortified millet products. Though millets are rich in micronutrients but majority of the nutrients remain unavailable due to the presence of anti nutrients that inhibits the nutritional values of millets which lead to deficient in diet of most Indian population. Hence, fortifying millets can enhance the nutrient availability and product developments. In the present era of food scarcity there exists a need to diversify the use of these millets by developing various millet recipes. Millet is delicious as a cooked cereal that can be used as a side dish and can be popped like corn for use as a snack or breakfast cereal. Properly stored, whole millet can be kept safe for up to two years. Millet is a highly nutritious, healthy and versatile grain that would be worthy adding to anyone's diet.

KEYWORD: - Millet, Cereals, Fortification, Micronutrients, Recipes

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INTRODUCTION

The grain, millet is one of the oldest foods known to humans. People in Africa and India use it in many of their recipes. Although millet is one of the world's most important food crops, it is cultivated mostly in the Eastern hemisphere and particularly in regions with primitive agricultural practices and high population densities. Its ability to grow on poorly fertilized or watered soils, has led millet to be labeled as a food for the poor. In the USA, millet is produced mostly for bird seed or cattle grain. So for those vegans who are frugal, this is an excellent choice in grains.

Millet is used to refer both the cereals and the plant that bears these edible grains. Studies concerning the origin of food grains reveal that millet is indigenous to Africa. Its origin dates back to about 4000 years ago. In fact, it is one of the oldest food crops known to us. Similar to other types of grains, millet is a grass that bears edible, small sized grains. Previously, millet was consumed as a staple food crop in India, Korea and China. Till today, this cereal remains a main crop in several parts of India, Nigeria, Africa and many other countries.

Basically, four types of millets are cultivated on a mass scale. They are pearl (most cultivated variety), foxtail, proso and finger millets**.** Millets are better adapted to dry, infertile soils than most other crops, and are therefore often cultivated under extremely harsh conditions - for example, high temperatures, low and erratic precipitation, short growing seasons and acidic and infertile soils with poor water-holding capacity. Most millets have strong, deep rooting systems and short life cycles, and can grow rapidly when moisture is available. As a result, they can survive and reliably produce small quantities of grain in areas where mean annual precipitation is as low as 300 mm.

In most parts of the world, millet is grown as a subsistence crop for local consumption. Commercial millet production is risky, especially in Africa, because the absence of large market outlets means that fluctuations in output cause significant price fluctuations, particularly in areas where millet is the main food crop. Apart from grain production, millet is also cultivated for grazing, green fodder or silage. Livestock are an important component of most millet production systems, and millet crop residues contribute significantly to fodder supplies. Some popular landrace varieties in India, for example, are over 3-meter tall, and are valued for the large amount of fodder they provide, even though grain yields are relatively low.

In developing countries, millet cropping systems tend to be extensive, with limited application of improved technologies, except in some of the more commercialized farming regions in India. These crops are usually grown without irrigation or chemical fertilizer, on light, well-drained soils that are poor in organic matter content. When supplementary or full irrigation is available, farmers prefer to cultivate more remunerative crops, although exceptions occur in some regions (such as Gujarat in India) where there is seasonally high demand for pearl millet crop residues as fodder for milch animals. Short-duration millet cultivars are also grown under irrigation, before or after higher-value crops, in areas where the season is long enough to permit double cropping.

For these reasons, and others discussed in the section on production trends, millet yields are usually much lower than yields of other cereals which are grown under more favourable conditions. Although millet occupies about 5 percent of the world's cereal area, it accounts for only 1.5 percent of world cereal production. Furthermore, yields are highly variable from one season to another. In Niger, for example, average pearl millet yields fell from 510 kg/ha in 1988 to 240 kg/ha in 1990, then increased to 360 kg/ha in 1992.

Millets have long been the staple food in the country. But polished rice, processed sugar and other refined food products produced using chemical fertilizers have become part of our daily life now. With no alternative, people have got accustomed to it and getting in the process, among other health disorders, diabetes, blood pressure and obesity.

In a bid to break this unhealthy trend, first in a series of Swedeshi Millets Food courts was opened here on Sunday by like-minded health-conscious people to make available a variety of dishes made with organically-produced ragi or finger millet, foxtail millet, pearl millet, proso millet and Sorghum.

CROP DISTRIBUTION

India is the world's largest producer, harvesting about 11 million tons per year, nearly 40 percent of the world's output. Pearl millet, which accounts for about two-thirds of India's millet production, is grown in the drier areas of the country, mainly in the states of Rajasthan, Maharashtra, Gujarat, Uttar Pradesh and Haryana. Finger millet is produced mainly in the state of Karnataka, but also in Orissa, Uttar Pradesh and Tamil Nadu. China produces about 3.7 million tons of millet (mainly foxtail) per

annum. Grown mainly in Uttarakhand, Madhya Pradesh, Maharashtra and Tamil Nadu, both as fodder and for human consumption, the barnyard millet has an amazing nutrition profile.

Millet production in Africa is distributed among a much larger number of countries, notably Nigeria (over 40 percent of the regional output), Niger, Burkina Faso, Mali, Senegal and Sudan Pearl millet is grown along the southern peripheries of the Sahara (i.e., the Sahelian countries and the northern parts of the coastal countries in Western Africa) and in the drier areas of Eastern and Southern Africa. Finger millet production is concentrated in Eastern and Southern Africa, where the leading producers are Uganda and Tanzania. As a grain crop, tef is largely confined to Ethiopia. Small quantities of white fonio are grown throughout sub-Sahelian Western Africa, most importantly in Mali. Black fonio is grown in isolated pockets in Nigeria, Togo and Benin. Guinea millet is cultivated only on the Fouta-Djallon plateau of northwestern Guinea and adjacent Sierra Leone. Foxtail and proso millets are very minor crops in Africa, but are cultivated to a limited extent in Kenya and other upland areas in Eastern Africa. Kodo millet is commonly harvested from wild forms in Western Africa, but cultivated forms of this "ditch millet" are only found in Asia. In Latin America, millet production is confined to a small area in Argentina.

Although millet represents less than 2 percent of world cereal utilization, it is an important staple in a large number of countries in the semi-arid tropics, where low precipitation and poor soils limit the cultivation of other major food crops[2.]

Most millet can be grown on low fertility soils. Some in acidic soils, some on saline soils. Millets such as pearl millet can also be grown on sandy soils, as is done in Rajasthan. In fact, finger millet grows well in saline soils. Barnyard millet too thrives in problem soils, where other crops like rice, struggle to grow in such soils. Many of them are also grown to reclaim soils. Poor farmers especially in dryland .Much of the cultivable fallows and low fertility farms have been handed to them through the process of land reforms. The only crops that sustain agriculture and food security on these lands are millets. In fact, the capacity of millets to grow on poor soils can be gauged from the fact that they grow in Sahelian soil conditions in West Africa which produces 74% of all the millets grown in Africa and 28% of the world production. If they flourish in such ecological zones where average rainfall can be less than 500 mm using soils that are sandy ,slightly acid, hardiness which has an extraordinary capacity to survive very harsh conditions. Millets can withstand in drought conditions which produces both food

and fodder for people and livestock, respectively[1]. Millets do not demand chemical fertilizers. In fact, under dry land conditions, millets grow better in the absence of chemical fertilizers. Therefore, most millet farmers grow them using farmyard manure under purely ecofriendly conditions and also started using biofertilisers such as vermicompost and growth promoters such as panchagavya, amrit pani etc. These practices make millet production not only ecofriendly but stays under the control of farmers. Most millet are pest free crops. And hence do not need any pesticides. Even in storage conditions, most millet do not need any fumigants, but act as anti pest agents to store delicate pulses such as green gram.

Millet utilization is mostly confined to the developing countries, even more so after production and utilization fell sharply in the CIS, the largest producer in the developed world. Accurate data are not available for most countries, but it is estimated that about 80 percent of the world's millet (and over 95 percent in Asia and Africa) is used as food, the remainder being divided between feed (7 percent), other uses (seed, beer, etc.,) .

Karnataka is one of the leading states in the production of millets, and the key millet growing regions in the state are Old Mysore, Bangalore rural, Chennapatna, and Kollegal, Tumkur, Gauribidnaur.Millets are priced between Rs 1,900 and Rs. 2,000 per quintal and finger millet costs Rs 1,600 to Rs. 2,000. The rise in prices is attributed to the low supply of the produce. The cultivation of millets is highly recommended for drought prone regions because these are low water consuming crops. Most millet are grown in low fertile soils. It is the ideal crop for climate crisis because it can withstand high temperature regimes. These include both acidic and saline soils. Pearl millets can be grown in the deserts too. It also does not demand synthetic fertilizers.

VARIATION IN GRAIN COMPOSITION

Like other cereals, sorghum and millets are predominantly starchy. The protein content is nearly equal among these grains and is comparable to that of wheat and maize. Finger millet contains the lowest fat. One of the characteristic features of the grain composition of millets is their high ash content. They are also relatively rich in iron and phosphorus. Finger millet has high fibre content and the highest calcium content among all the food grains. Generally, the whole grains are important sources of B-complex vitamins, which are mainly concentrated in the outer bran layers of the grain. Sorghum and millets do not contain vitamin A, although certain yellow endosperm varieties contain small amounts of 13-carotene, a precursor of vitamin A. No vitamin C is present in the raw millet grains.

Differences in grain composition in genotypes of millets have been reported. In finger millet, the value ranges reported are protein, 5.8 to 12.8 percent; fat, 1.3 to 2.7 percent; total ash, 2.1 to 3.7 percent; and carbohydrate 81.3 to 89.4 percent. Variations in the mineral content of these varieties were also large. Differences in the protein and mineral composition of finger millet hybrids have also been reported.

Grain protein and its amino acid composition in sorghum differ with the location at which the crop is grown. The level of nitrogen fertilizer also influences the quantity and quality of protein in sorghum and it is noted that application of nitrogen fertilizer increases the grain yield and protein, but had no effect on the mineral composition of grain sorghum. However, the mineral content of the sorghum does increase with increasing levels of phosphorus fertilizer. Other factors such as the density of the plant population, season and water also contribute to variations in grain composition.

This can be stored for many years under normal room temperature. India is the largest producer of millet grains, producing about 33–37% of a total of 28million tonnes of the world produce. Finger millet is converted to flour for preparation of various food items.

How Millet is Used

Millet grain is the basic diet for farm households in the world's poorest countries and among the poorest people. In the Sahelian zone of Africa, pearl millet is the staple cereal. Millet straw is a valuable livestock feed, building material, and fuel in those farming systems. Exports and imports of millet grain are negligible suggesting low demand, and/or unreliable availability of marketable surpluses, for this commodity in world markets.

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Sorghum and finger millet grains are traditional staple foods in Kenya. However, they have naturally occurring anti-nutritional factors, such as phytic acid, that decrease their dietary availability.

Fermentation increased the rate of available iron, manganese, and calcium in both sorghum and finger millet. The available minerals were generally higher in finger millet than in sorghum after fermentation. Fermentation was also more effective than malting in reducing phytic acid in sorghum and finger millet. Simple traditional food processing methods can therefore be used to increase mineral availability.

The fatty acid composition of common millet and foxtail millet did not differ from that of sorghum[3]. Common millet was found to contain 1.8 to 3.9 percent lipids, and about 24 percent of the grain fat was in the embryo component. The fatty acid profile showed that saturated fatty acids totaled 17.9 to 21.6 percent while unsaturated fatty acids totaled 78 to 82 percent. The unrefined fat extracted from the kernel of common millet contained 8.3 to 10.5 mg vitamin A and 87 to 96 mg vitamin E per 100 g. On refining, all the vitamin A activity was lost and there was significant loss in vitamin E. Vitamin E is also present in the fat extracted from sorghum grain.

Sorghum and millets will continue to be major food crops in several countries, especially in Africa (and in particular in Nigeria and the Sudan, which together account for about 63 percent of Africa's sorghum production). These grains are used for traditional as well as novel foods. However, there is a need to look into the possibilities of alternative uses. Though sorghum and millets have good potential for industrial uses, they have to compete with wheat, rice and maize.

In the North of India, it has been used, since time immemorial, during the fasting period of Navratras, as not only is it high on energy but it is also light on the stomach, both eminently desirable properties during long fasting periods.

In the Garhwal Hills, where women have to toil hard at farming on the step-cultivation system and therefore need a sustaining diet, they have evolved many mouth-watering dishes with Jhangora; apart from the festive kheer, there is also a kadhi called Jhangora ka chencheda.

Nutritional Composition of Millets and its health benefits

Millets are miles ahead of rice and wheat in terms of their mineral content, compared to rice and wheat. Each one of the millets has more fibre than rice and wheat. Finger millet has thirty times more calcium than rice while every other millet has at least twice the amount of calcium compared to rice. Every single millet is extraordinarily superior to rice and wheat and therefore is the solution for the

malnutrition that affects a vast majority of the Indian Population. High in B-complex vitamins, millet is packed with more than most grains. It is rich in protein, minerals, and lecithin. And for those with allergies, millet is the least offensive of all grains[3.]

A studied has been carried out and was found to be millet is the only grain able to supply experimental animals with all the essential amino acids and vitamins when fed as the exclusive food. When cooked a mucilaginous substance rises to the surface of millet. It appears that this substance has some healing action in cases of gastrointestinal inflammation and ulceration. Millet is one of the most easily digested and handled of all grains. Millet is highly nutritious, non-glutinous unlike buckwheat and quinoa, is not an acid forming food so is soothing and easy to digest. In fact, it is considered one of the least allergenic and most digestible grains available and it is a warming grain so will help to heat the body in cold or rainy seasons and climates.

Table 1.Nutrient content of millets (per 100gm)

Millet	Protein (g)	Carbohydrate (g)	Fat (g)	Energy (k.cal)	Calcium (mg)	Iron (mg)	Crude Fibre (g)	Phosphorus (mg)	Minerals (mg)
Finger millet	7.3	72.0	1.3	328	25	3.9	3.6	283	2.7
Pearl millet	11.6	67.5	5.0	361	42	16.9	1.2	296	2.3
Foxtail millet	12.3	60.9	4.3	331	31	2.8	8.0	290	3.3
Little millet	8.7	75.7	5.3	341	17	9.3	8.6	220	1.5
Kodo millet	8.3	65.9	1.4	309	27	0.5	9.0	188	2.6
Barnyard millet	11.6	74.3	5.8	300	14	15.2	14.7	121	4.4

1. Nutritive Value of Indian Foods, 2010[14]
2. Millet Network of India- Profile of millets Securing food, securing climate[4]

Millet is tasty, with a mildly sweet, nut-like flavor and contains a myriad of beneficial nutrients. It is nearly 15% protein, contains high amounts of fiber, B-complex vitamins including niacin, thiamin, and riboflavin, the essential amino acid methionine, lecithin, and some vitamin E. It is particularly high in the minerals iron, magnesium, phosphorous, and potassium. The seeds are also rich in phytochemicals, including Phytic acid, believed to lower cholesterol, and Phytate, which is associated with reduced

cancer. Millet is more than just an interesting alternative to the more common grains. Our food ranking system qualified it as a good source of some very important nutrients, including manganese, phosphorus, and magnesium.

Heart-Protective Properties

Although oats have been widely publicized for their heart-protective properties, millet is a grain that should be included on a list of heart-healthy choices because of its status as a good source of magnesium. Magnesium has been shown in studies to reduce the severity of asthma and to reduce the frequency of migraine attacks. Magnesium has also been shown to lower high blood pressure and reduce the risk of heart attack, especially in people with atherosclerosis or diabetic heart disease. Niacin (vitamin B3) can be of help in lowering high cholesterol. A cup of cooked millet provides 26.4% of the daily value for magnesium.

Development and Repair of Body Tissue

The phosphorus provided by millet plays a role in the structure of every cell in the body. In addition to its role in forming the mineral matrix of bone, phosphorus is an essential component of numerous other life-critical compounds including *adenosine triphosphate* or ATP, the molecule that is the energy currency of the body. Phosphorus is an important component of nucleic acids, the building blocks of the genetic code. In addition, the metabolism of lipids (fats) relies on phosphorus, and phosphorus is an essential component of lipid-containing structures such as cell membranes and nervous system structures. A cup of cooked millet will give you 24.0% of the daily value for phosphorus.

Millet and Other Whole Grains Substantially Lower Type 2 Diabetes Risk

Millet and other whole grains are a rich source of magnesium, a mineral that acts as a co-factor for more than 300 enzymes, including enzymes involved in the body's use of glucose and insulin secretion.

Risk of type 2 diabetes was 31% lower in black women who frequently ate whole grains compared to those eating the least of these magnesium-rich foods. When the women's dietary intake of magnesium intake was considered by itself, a beneficial, but lesser—19%—reduction in risk of type 2 diabetes was found, indicating that whole grains offer special benefits in promoting healthy blood sugar control[8]. Daily consumption of low-fat dairy foods was also helpful, lowering risk of type 2 diabetes by

13%. Enjoy a hearty breakfast and get the benefits of both millet and dairy by serving a hot bowl of millet topped with low-fat milk and your favorite dried fruit, nuts or seeds.

Helps Prevent Gallstones

A study has been done on eating foods high in insoluble fiber and has been published in the American Journal of Gastroenterology and was found that it helped women to prevent gallstones.

Studying the overall fiber intake and types of fiber consumed over a 16 year period by over 69,000 women in the Nurses Health Study, researchers found that those consuming the most fiber overall (both soluble and insoluble) had a 13% lower risk of developing gallstones compared to women consuming the fewest fiber-rich foods.

Fiber from Whole Grains and Fruit Protective against Breast Cancer

When researchers looked at how much fiber 35,972 participants in the UK Women's Cohort Study ate, they found a diet rich in fiber from whole grains, such as millet, and fruit offered significant protection against breast cancer for pre-menopausal women[13]

Fiber supplied by whole grains offered the most protection. Pre-menopausal women eating the most whole grain fiber (at least 13 g/day) had a 41% reduced risk of breast cancer, compared to those with the lowest whole grain fiber intake (4 g or less per day).

Fiber from fruit was also protective. Pre-menopausal women whose diets supplied the most fiber from fruit (at least 6 g/day) had a 29% reduced risk of breast cancer, compared to those with the lowest fruit fiber intake (2 g or less per day).

Storage of millet

In developing countries, it is usually stored in small quantities in traditional containers, often on the farm. Large quantities are seldom accumulated and bulk storage is uncommon. The objective of storage is to preserve as much as possible of the value of the grain for its intended future use. This means either retaining as high a proportion of viable seeds as possible for planting at the next harvest or preserving as much as possible of the food value of the grain for as long as possible. Several factors lead to the loss of both viability and nutrients, but globally the main causes of loss are the depredations of

pests (insects, birds and rodents) and mould damage. Germination of the grain (sprouting) also results in losses, but on a smaller scale. Grain is stored by consumers and by processors for future consumption[4.] It is also stored by commercial traders for resale, usually on the home market but occasionally for export.

Moisture in the grain and the temperature of storage are the most important physical factors that contribute to losses[11.] Most activity that causes losses occurs more rapidly as the temperature increases. With even minor changes in temperature, moisture will migrate and accumulate in certain areas, either near the top of the container or in places that are cooler than the rest. This often allows microbiological activity to occur in comparatively dry grain. Microbiological activity usually produces heat, and in unventilated stores, moist areas can get so hot that charring can occur. At this stage the grain is ruined. It may even burst into flames when it is exposed to air.

Storage bins are best filled early in the day when the air is cool and the humidity is often at its lowest. The grain should be packed as tightly as possible to allow insects the minimum space to move around and to breed. Sand is sometimes mixed with the grain to reduce the free space further. In some countries in West Africa sorghum and millet grains are mixed with wood ash and stored in clay pots[9.] In Nigeria sorghum and millets are stored as unthreshed heads in a solid walled container called a rumbu. For short-term storage, bundles of sorghum and millet heads are arranged in layers in the rumbu. For long-term storage of three to six years, the heads are laid out individually rather than in bundles. Some farmers spread the leaves of gwander daji (Anona senegalensis) on the bottom of the rumbu and between each layer of grain. When a rumbu is full, the mouth is sealed with clay. In Uganda, sorghum is threshed and stored in gunny sacks, whereas millets are stored unthreshed. In the Sudan, pits holding 2 to 5 tonnes of grain are used as underground stores. Most of the sorghum and millets grown in Andhra Pradesh are grown for personal consumption. Occasionally sorghum and millets are stored on the ground, usually unthreshed. The earheads are heaped in a pile (either indoors or outdoors) and covered with straw. As the grain is needed, earheads are removed and threshed. More often, grain is stored in gunny sacks, which are stacked either on the floor or on raised wooden platforms. Underground pits, which may be located underneath the house or outside, are also used. The pit is lined with paddy straw or sorghum straw. When it is full of grain the grain is covered with straw and soil. For longer-term storage, the top is plastered over with mud. Storage jars, silos and bins are made from a number of different materials. On the smallest scale, grain is stored in clay pots. Larger containers are made from

wood, brick or stone or from bamboo made into a basket which is then sealed with clay or dung. When these containers are kept indoors they are sometimes left uncovered, but when they are kept outdoors they are covered with either a lid or a thatched roof. If the grain is to be stored for a long time, the top of the bin is plastered over with mud or dung. Occasional exposure to sunshine is the most commonly used measure for preventing insect infestation. Flour is usually produced as it is needed and is not often stored for long periods because it tends to turn rancid. This is particularly evident with pearl millet flour, because of its very high fat content. Sorghum and millets, particularly pearl millet, are therefore best stored as whole grain. If it is kept dry and away from mice or birds, millet can be stored for two years. Insects and rotting seems to be little threat to millet. The best method and simple way is to keep dry, cool place in a closed container.

Millets are multiple security crops

While single crops such as rice and wheat can succeed in producing food security for India, millets do more. They contribute to securities of food, nutrition, fodder, fibre, health, livelihood and ecology. Most millet have edible stalks which are the most favoured fodder for cattle. Sometimes, crops such as sorghum and pearl millet are grown only for their fodder.

Besides fodder, millets are storehouses of nutrition and hence provide nutrition security. Being hosts to diverse crops such as red gram and amaranth, millet fields produce fuel wood and fibre.

The legume crops that are companion crops for millets are also prolific leaf shedders. The fallen leaves act as natural manure and maintain soil fertility. Thus, millet farms do not just use soil fertility for their growth, but also return this fertility to the soil. Ultimately, their energy balance sheet in making major efforts to ensure the consumption of millets is on the rise. In this regard considerable importance is given to processing and value addition of finger millet or small millets. The millets are known to be low in dietary bulk, high in nutrient density and known for its good profile of amino acids, according to officials from the department of food and nutrition, a division of Home Science, University of Agricultural Sciences, Bangalore.

An event was organised by Rainbow Lifeline Conservation Society and non-governmental organisations to highlight the forgotten millets, value-added food products and brings back some of the

forgotten millets such as foxtail millet, sorghum, kodo millet, little millet, proso millet, and barnyard millet. Among the value added products are ready-to-eat flour like papad , chaklis, cakes and biscuits.

The biggest advantage of millets is that it can provide multiple security like food, nutrition, fodder, fibre, health, livelihood and ecology, according to Millet Network of India – Deccan Development Society-FIANIndia[4.]

In terms of nutrition, millets are far more valuable than rice and wheat. Finger millet has 30 times more calcium compared to rice. Foxtail and little millet are also higher in nutrition compared to rice. It also contains high quantity of beta carotene.

According to G Krishna Prasad, director, Sahaja Samrudha, there is an urgent need to put millets in the Public Distribution System. Millets are also water saving and drought tolerant crops. Therefore, they must be viewed as climate change compliant crops. This factor makes the crop India's food and farming future.

Different parts of India grow diverse kinds of millets. While Rajasthan is home to the pearl millet (Bajra), Deccan Plateau comprising Marathwada in Maharashtra, Telangana in Andhra Pradesh and parts of North Karantaka are well-known for sorghum or great millet. Southern Andhra Pradesh, Tamil Nadu, Orissa and southern Karnataka are known for finger millet or ragi. Uttarakhand and other hilly areas grow a range of small millets like foxtail and proso, kodo and barnyard. If the public distribution system includes these millets, then it will provide the below the poverty line population a food and nutritional security programme.

The pro-millet PDS paradigm must depend on a completely decentralised approach based on local production, local storage and local distribution, said Prasad. However, this must be supported by the government both in procurement and in storage. The government must, on a war footing, provide space for millet based foods in ICDS (Integrated Child Development Services), school meals and welfare hostel programmes. This will overcome the problem of malnutrition of young children where India fares worse than the sub-Saharan region.

The focus should be given to the productivity of rainfed lands where millets are grown. This could be achieved through special water shed on millet lands and dovetailing the government's employment

programme such as NREGA (National Rural Employment Guarantee Act) to support millet cultivation from sowing to harvesting. All the energy they import for their cultivation is returned by them to the soil

Millet –the best vehicle for fortification

Fortification may be the cheapest, easiest and best way to combat micro nutrient deficiencies which is the major problem facing in our country like India. Millet being less expensive compared to other cereals and staple food for the downtrodden people could be chosen as the best vehicle for fortification. Micronutrients such as iron, zinc, calcium and vitamins can be used as fortificants in millets[9.] Millets such as finger millet, pearl millet, barnyard millet are some of the millets that are used in various food items. It is also one of the most nutritious cereal among the various crops. It is widely grown in most parts of the country. Millets can be incorporated into bakery products as well and it is slowly started using in some of the bakery outlets. And it is nutritious than refined flour. A study has revealed and concluded that finger millet flour can effectively be used as a vehicle for zinc fortification to derive additional amounts of bioaccessible zinc, with reasonably good storage stability, to combat zinc deficiency. Deficiency of zinc is believed to be as widespread as that of iron, with equally serious consequences. Fortification of staple foods with minerals like iron and zinc are one of the cost effective method to combat the micro nutrient deficiencies[7.] Fortification of millet flours with iron might be beneficial in combating iron deficiency. A study has showed that a discoloration was perceived in the dumplings prepared from the same flours where as the overall quality of items like roti prepared was acceptable to the sensory panelists[10.] Finger millet and sorghum flours seem to be suitable as vehicles for fortification with iron.

CONCLUSION

India needs to secure its food and farming for this century; there is an urgent need to recognize millets as the future food for the country and can adopt various relevant steps. It is also important to realize that for a New Age crisis such as the Climate Crisis, millets are a New Age Answer[1]. Cereal grains, millet also called as Miracle Grain by The Millet Network Of India can accord as the highest priority to the introduction of millets in India's Public Distribution System. It should incentivize millet cultivation in order to mitigate the alarming state of malnutrition in India, urgently start a massive awareness campaign on the nutritional value of millets and revise our educational curriculum to include

learning on traditional millet agricultural practices and inculcate on developing various traditional recipes using millets.

In times of climate change, when we need climate resilience our Forgotten Foods can become foods of the future, given their adaptable ecological behaviour[6]. As we become eco-citizens, our food choices can help reduce our carbon footprints, by choosing to eat locally grown ingredients and in the case of millets, it can also be our small resistance to GM foods.

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