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Millets: God Gifted Nutrient Rich Food Crops

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Abstract

Millets are considered as god gifted crops due to the nutrient content and their benefits on human health. Different types of millets includes finger millet, barnyard millet, proso millet, foxtail millet, little millet, kodo millet, pearl millet and sorghum. Millets have high amount of nutrients including protein, fat, starch, ash, crude fiber, dietary fiber and carbohydrate. These minor millets also contain high content of the minerals also such as calcium, phosphorus, iron, magnesium, sodium, potassium, copper, manganese and zinc. Other than the nutrients and minerals these crops have sufficient amount of thiamine, riboflavin, niacin *etc.* Previously these crops were known as poor man crops but now called as nutri-cereal crops. These minor millets have many health beneficial properties such as reducing cholesterol, controlling diabetes, weight loss, increases bone strength, increases digestion *etc.*

Introduction

Most of the millet crops are predominantly cultivated for human consumption and livestock feed. They are less susceptible to biotic and abiotic stresses and also good source of nutrients. Even these nutricereal crops are superior to the cereals and have the potential to provide food and health beneficial nutrients but their utilization is still limited. These crops are especially rich in dietary fibres, antioxidants, phytochemicals and polyphenols, which contribute broad spectrum positive impacts on human health. Due to severe malnourishment effects on human health especially in children, suffers from stunting and underweight. In 2020, the malnutrition affects the children about 149.2 million stunting, 45.4 million wasting and 38.9 million overweight, globally (UNICEF, 2021).

The finger millet, barnyard millet, foxtail millet, proso millet, little millet, kodo millet and pearl millet are good source of nutrients and sorghum is also an important crop for dual, grain as well as fodder purposes. These crops have an ability to grow well under the marginal conditions of soil fertility and moisture. Genetic improvement is an important method to improve the crops and introgression of their desirable traits into other crops through omics technology. These crops are naturally nutrient rich crops besides this some of the institutes have developed the bio-fortified varieties of millets. The varieties CFMV-1 and CFMV-2 in finger millet and CLMV-1 in little millet have been developed. The variety of iron biofortified variety has been developed and reported 7-8 mg/ 100 g in pearl millet (Lal *et al.*, 2021). In sorghum also a nutrient rich first bio-fortified variety Parbhani Shakti has been developed by ICRISAT and released by VNMKV, Maharashtra in 2018.

Pearl Millet

Pearl millet [*Pennisetum glaucum* (L.) R. Br.] is sixth most important cereal crop after rice, wheat, maize, barley and sorghum and widely grown in the arid and semi-arid regions of Asia and Africa. Its vernacular names in India are Bajra, sajjai, kamboo, sajjalu, bajari etc. The major states growing pearl millet are Rajasthan, Maharashtra, Gujarat, Uttar Pradesh and Haryana. Pearl millet has capacity to resistance in drought, low soil fertility and high salinity conditions. The Ministry of Agriculture, Government of India has notified the pearl millet in Nutri-cereals based on its nutritional quality. It is a good source of energy, protein, vitamins, dietary fibers and minerals and high in fat and better fat digestibility than other cereals. Also contains high unsaturated fatty acids and n-3 fatty acid (Satankar *et al.*, 2020). Among all the millets, pearl millet has highest content of macronutrients and significantly rich in resistant starch, soluble and insoluble dietary fiber (Figure 1).

Finger Millet

Finger millet is one of the important minor millets. The scientific name of finger millet is *Eleusine coracana* (L.) Gaertn. Karnataka is one of the major finger millet growing states in India. Millets specially finger and foxtail millets having good sources of micro and macronutrients with high nutraceutical and antioxidant properties also rich in protein, fat, crude fiber, iron, and other minerals and vitamins. Locally it is known by different names in India as Ragi, Mandua, Koda etc. (Figure 2).



Figure 1: Pearl millet



Figure 2: Finger millet

Barnyard Millet

Barnyard millet is scientifically known as *Echinochloa frumentaceae* L. and locally it is known by different names in India like Jhangora, Sanwa etc. It is important minor millet for food and fodder for cattle and having high content of dietary fiber. It is highly nutrient rich crop. It contains high phosphorus, iron, zinc etc. Few pest and diseases are belongs to this crop which causes reduction in yield losses but it is mostly affected by smut and leaf spot (Figure 3).

Proso Millet

Proso millet is a warm season crop and has potential of high nutritive value for human consumption, bird seed and animal feed and fodder purposes. The scientific name of proso millet is (*Panicum miliaceum* L.). Generally, all the millets sustain in drought condition among them proso millet is one of the drought tolerant crop. It is well adapted crop in high elevation. Approximately 20-30 °C temperature is required for the germination and sensitive to frost condition (Figure 4).



Figure 3: Barnyard millet



Figure 4: Proso millet

Foxtail Millet

Foxtail millet [*Setaria italica* (L.) P. Beauv] is a rainfed crop. It has a capacity to sustain in naturally stress condition. It is considered as warm food. This millet has vernacular names as koni, kangani, kakum, navane, korra, kang, rala etc. in different part of India. It is oldest cultivated crop which contains several nutrients, minerals, vitamins and antioxidants etc. Most of the people are uses of foxtail in the form of popped seed. Despite of good qualities of foxtail millet, it has limited area of cultivation (Figure 5).



Figure 5: Foxtail millet

Little Millet

Little millet (*Panicum sumatrense*) is termed as cool food because it has a cooling effect when consumed in summer duration. Locally it is known as kutki, same, samalu, samai, sava, kuri, kangani, sawank etc. In addition to nutritional benefits, these grains also store numerous phytochemicals mainly phenolic compounds, which help in chronic disorders like cancer, diabetes and cardiovascular diseases management. Although little millet is nutritionally superior to cereals, yet it's utilization is limited. The major factor of discouraging its cultivation and consumption is the drudgery associated with its processing (Figure 6).

Kodo Millet

Kodo millet (*Paspalum scrobiculatum*) is known by several names in the different part of India like kodo, kodon, kodara, harka, varagu, arikelu, arika etc. It is an extremely hardy and drought tolerant crop that can survive on marginal soils where other crops may not survive easily. In hills like Uttarakhand, farmers grow only finger millet, barnyard and proso millet and do not cultivate other millets like little and kodo millet. It might be due to either less aware regarding to the nutritional property or its low production, popularity and consumption. Some of the research represents it does not contain gluten, which makes it an appropriate food for those are suffering from celiac disease or other forms of allergies or intolerance of wheat. It also contains high fiber content, polyphenols and proteins composition, can contribute significantly to the nutritional security of large section of population (Sharma *et al.*, 2017). The strong correlation between the antioxidants properties of plant derived polyphenolic compounds and their health-promoting and disease preventing effects.

Sorghum

Sorghum [*Sorghum bicolor* (L.) Moench] is fifth most important cereal crop after wheat, rice, maize and barley. In area and production it is third most important cereal crop after rice and wheat. It is used as a dual purpose like grain and fodder. Sorghum is also nutrient rich crop like other millets. It is also a drought tolerant crop because of having hydrocyanic acid (HCN) content. Higher HCN content positively correlated with drought tolerance. Some varieties like Brown Mid Rib (BMR) type of sorghum has higher digestibility. The cultivation of this crop is mainly in Maharashtra, Karnataka, Andhra Pradesh, Madhya Pradesh, Tamil Nadu, Uttar Pradesh, Rajasthan, Gujarat, Haryana etc. Locally it is known by different names as jowar, jola, cholam, jonna, juar, jawari etc. It helps in obesity and diabetes control, gastro-intestinal tract disorder, hypercholesterol control etc. (Figure 7).

The composition of nutrients, vitamins and amino acid contents in millets and cereals is presented in Table 1 and 2.



Figure 6: Little millet



Figure 7: Sorghum

Table 1: Nutrient composition of millets and cereals grains

Sl. No.	Crop Name	Protein (%)	Fat (%)	Starch (%)	Ash (%)	Crude fiber (%)	Total dietary fiber/ 100 g	Carbohydrate (g)	Total phenol (mg/ 100 g)
1	Finger millet	7.3	1.3	59.0	3.0	3.6	19.1	72.6	102.0
2	Barnyard millet	6.2	4.8	60.3	4.0	13.6	13.0	65.5	26.7
3	Proso millet	11.0	3.5	56.1	3.6	9.0	8.5	0.1	70.4
4	Foxtail millet	11.7	3.9	59.1	3.0	7.0	19.11	60.9	106.0
5	Kodo millet	8.3	1.4	72.0	3.6	9.0	37.8	65.9	368.0
6	Little millet	7.7	4.7	60.9	6.9	7.6	-	67.0	21.2
7	Pearl millet	14.5	5.1	60.5	2.0	2.0	7.0	67.5	51.4
8	Sorghum	11.0	3.2	73.8	1.8	2.7	11.8	72.6	43.1
9	Wheat	14.4	2.3	64.0	1.8	2.9	12.1	71.2	20.5
10	Rice	7.5	2.4	77.2	4.7	10.2	3.7	2.51	78.2

Source: Chandra *et al.* (2016)

Table 2: Composition of mineral and vitamins (mg/ 100 g) and amino acid (g/ 100 g) of millets and cereals grains

Sl. No.	Crop Name	Ca	P	Fe	Mg	Na	K	Cu	Mn	Zn	Thiamine	Riboflavin	Niacin	Lysine	Tryptophan
1	Finger millet	344	283	3.9	137	11.0	408	0.47	5.49	2.30	0.42	0.19	1.10	0.220	0.100
2	Barnyard millet	22	280	18.6	82	-	-	0.60	0.96	3.00	0.33	0.10	4.20	-	-
3	Proso millet	8	206	2.9	114	5.0	195	0.80	1.60	1.70	0.41	0.28	4.50	0.190	0.050
4	Foxtail millet	31	290	2.8	143	1.3	364	0.59	1.16	3.51	0.59	0.11	3.20	0.140	0.060
5	Kodo millet	35	188	1.7	110	4.8	141	1.60	1.10	0.70	0.15	0.09	2.00	0.150	0.050
6	Little millet	17	220	9.3	61	7.9	126	0.05	0.68	3.70	0.30	0.09	3.20	0.110	0.060
7	Pearl millet	42	240	11.0	137	10.0	390	1.06	1.15	3.10	0.38	0.21	2.80	0.190	0.110
8	Sorghum	13	289	3.4	165	2.0	363	1.70	1.60	1.70	0.33	0.10	3.70	0.229	0.124
9	Wheat	41	306	3.9	120	3.0	363	0.90	13.30	1.00	0.41	5.46	5.50	0.230	0.080
10	Rice	10	160	0.5	32	6.0	130	0.25	1.10	1.20	0.41	0.015	1.62	0.170	0.070

Source: Chandra *et al.* (2016)

Conclusion

All the above mentioned millets are very astonishing crops not only for nutrition purpose also helps to minimize or controlling the some disorder or diseases. We all know about the human life style in present day. These crops are a boon for establishing the nutritional security for poor children's as well as starving areas. These are important for poor as well as richest people for consuming nutrition and maintaining health. Therefore, we should apply these crops products in our routine life style.

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