

Nutritional Benefit of Small Millets: Food Security & Sustainability in India

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Introduction:

Small-grained cereal grasses are collectively called as 'Millets', being one of the oldest cultivated foods known to humans. There are two main groups of millets first group consist of major millets (sorghum and pearl millet) and second group has small millets this categorization is based on the grain size, this classification is also an indication of the area under cultivation of these crops, but both (major and small millets) have traditionally been the main components of the food basket of the poor people in India, especially indry-land farming system in India and elsewhere. Among these small millets are known by different vernacular names in different parts of the country (Table-1). The group of small millets is represented by six different species, namely finger millet (*Eleusine coracana*), little millet (*Panicum sumatrance*), kodo millet (*Paspalum scrobiculatum*), foxtail millet (*Setaria italic*), barnyard millet (*Echinochloafrumentacea*) and proso millet (*Panicum miliaceum*), representing the area grown in that order.

Geographical distribution:

Among small millets, finger millet is the most important crop grown in many states of Southern, Central, Eastern, Western and Northern India from sea level to 8000 feet altitude. The loss of area under finger millet has been less on account of improvement in productivity. On the contrary the area under other small millets has reduced by more than half with proportionate reduction in total production. The productivity remained low and stagnant around 450 kg/ha. Recent and accurate statistics regarding each of the small millets is still lacking by far it is clear that more than 60% of area under small millets is occupied by finger millet, distantly followed by little and kodo millets (just above 10%) and followed by barnyard, foxtail and proso millets.

Though small millets are grown in almost every state of the India, the distribution of individual millet is not uniform. The kodo, little and foxtail millets are grown widely in Karnataka, Tamil Nadu, Andhra Pradesh, Orissa, Bihar, Madhya Pradesh and Maharashtra. In Madhya Pradesh, both kodo and little millet are predominant, while foxtail millet is important in Andhra Pradesh and Karnataka. Barnyard millet and proso millet are grown largely in hills of Uttar Pradesh, North-Eastern region and plains of North Bihar and Western Uttar Pradesh and Maharashtra.

Table-1: Vernacular names of small millets in different parts of the country.

Language	Small millets					
	Finger millet	Little millet	Kodo millet	Foxtail/ Italian millet	Barnyard millet	Proso millet
Hindi	Mandua	Kutki	Kodon	Kangni, Kakum	Sanwa, Jhangon	Barre
Sanskrit	Nandimukhi, Madhuli	-	Kodara	Kanguni	Shyama	Chiná
Kannada	Ragi	Same	Harka	Navane	Oodalu	Baragu
Tamil	Kelvaragu	Samai	Varagu	Tenai	Kuthiravali	Panivaragu
Telugu	Ragulu	Samalu	Arikelu, Arika	Korra, Korralu	Udalu, Kodisama	Varigulu, Varagalu
Malayalam	Moothari	Chama	Varagu	Thina	-	Panivaragu
Marathi	Nachni	Sava	Kodra	Kang, Rala	Shamul	Vari
Gujarati	Nagli, Bavto	Gajro, Kuri	Kodra	Kang	Sama	Cheno
Bengali	Mandua	Kangani	Kodo	Kaon	Shamula	Cheena
Oriya	Mandia	Suan	Kodua	Kanghu, Kora	Khira	Chinna
Punjabi	Mandhuka, Mandhal	Swank	Kodra	Kangni	Swank	Cheena
Kashmiri	-	Ganuhaar		Shol	-	Pingu

Properties and nutritional profile:

The small millets are small seeded grains that resemble paddy or rough rice in the morphological features of kernel. The kernel consists of distinct husk, bran and endosperm tissues. Embryo is a distinct tissue, but its proportion in the kernel is around 2%. The husk is non-edible similar to the husk in rough rice or paddy whereas bran may be part of the edible component but is separated to prepare milled millets for food uses. Normally, husk accounts to 15 to 20% of the kernel whereas the bran amount to about 5% and the endosperm to about 75% of the kernel, respectively. These grains are round to oval shaped and their 1000-kernel

weight and volume range from 1.9 - 5.5 g and 1.3 - 3.8 ml, respectively. The seed coat and husk of foxtail, little and proso millet are generally of single entity with glossy appearance whereas kodo and barnyard millet contain multiple layered seed coat. Normally the seed coat of kodo millet is of brown colour, foxtail millet is yellowish whereas the other millets are greyish coloured. The husk is non-edible and unusually hard to digest similar to the husk in paddy, whereas the bran is edible. To prepare edible items out of millets, the husk is separated by milling and along with that generally, the bran is also separated similar to milled rice. Hulling does not affect the nutrient value as the germ stays intact through this process.

Small millets are more nutritious compared to fine cereals. Finger millet is the richest source of calcium (300-350 mg/100 g) and other small millets are good source of phosphorous and iron. The protein content ranges from 7 to 12% and fat content from 1 to 5.0% (Table-2). The millet protein has well balanced amino acid profile and good source of methionine, cystine and lycine. These essential amino acids are of special benefit to those who depend on plant food for their protein nourishment. The millet grain contains about 65% carbohydrate, a high proportion of which is in the form of non-starchy polysaccharides and dietary fibre which help in prevention of constipation, lowering of blood cholesterol and slow release of glucose to the blood stream during digestion. Lower incidence of cardiovascular diseases, duodenal ulcer and hyperglycemia (diabetes) are reported among regular millet consumers. Millet grains are also rich in important vitamins viz., Thiamine, riboflavin, folic and niacin and are comparable to rice and wheat or even rich in some of the minerals (Table-3) as well as fatty acids (Table46). Millets vary largely in composition of carbohydrates as proportion of amylose and amylopectin content vary from 16-28% and 72-84%, respectively (Table-5).

Table-2: Nutrient composition of millets compared to fine cereals (per 100 g).

Food gain	Carbo-hydrates (g)	Protein (g)	Fat (g)	Energy (KCal)	Crude fibre (g)	Mineral matter (g)	Ca (mg)	P (mg)	Fe (mg)
Finger millet	72.0	7.3	1.3	328	3.6	2.7	344	283	3.9
Kodo millet	65.9	8.3	1.4	309	9.0	2.6	27	188	0.5
Proso millet	70.4	12.5	1.1	341	2.2	1.9	14	206	0.8
Foxtail millet	60.9	12.3	4.3	331	8.0	3.3	31	290	2.8
Little millet	67.0	7.7	4.7	341	7.6	1.5	17	220	9.3

Barnyard millet	65.5	6.2	2.2	307	9.8	4.4	20	280	5.0
Sorghum	72.6	10.4	1.9	349	1.6	1.6	25	222	4.1
Bajra	67.5	11.6	5.0	361	1.2	2.3	42	296	8.0
Wheat (whole)	71.2	11.8	1.5	346	1.2	1.5	41	306	5.3
Rice (raw, milled)	78.2	6.8	0.5	345	0.2	0.6	10	160	0.7

(Source: Nutritive value of Indian foods, NIN, 2007).

Table-3: Micronutrient Profile of Millets (mg/100g).

Millets	Mg	Na	K	Cu	Mn	Mb	Zn	Cr	Su	Cl
Foxtail	81	4.6	250	1.40	0.60	0.070	2.4	0.030	171	37
Proso	153	8.2	113	1.60	0.60	-	1.4	0.020	157	19
Finger	137	11.0	408	0.47	5.49	0.102	2.3	0.028	160	44
Little	133	8.1	129	1.00	0.68	0.016	3.7	0.180	149	13
Barnyard	82	-	-	0.60	0.96	-	3	0.090	-	-
Kodo	147	4.6	144	1.60	1.10	-	0.7	0.020	136	11
Sorghum	171	7.3	131	0.46	0.78	0.039	1.6	0.008	54	44
Bajra	137	10.9	307	1.06	1.15	0.069	3.1	0.023	147	39
Rice	90	-	-	0.14	0.59	0.058	1.4	0.004	-	-
Wheat	138	17.1	284	0.68	2.29	0.051	2.7	0.012	128	47

(Source: Nutritive value of Indian foods, NIN, 2007; MILLET in your Meals, <http://www.sahajasamrudha.org/>).

Table4: Fatty acid composition of millets.

Millet	Palmitic	Palmoleic	Stearic	Oleic	Linoleic	Linolenic
Foxtail	6.40	-	6.30	13.0	66.50	-
Proso	-	10.80	-	53.80	34.90	-
Finger	-	-	-	-	-	-
Little	-	-	-	-	-	-
Sorghum	14.0	-	2.10	31.0	49.0	2.70
Bajra	20.85	-	-	25.40	46.0	4.10
Rice	15.0	-	1.90	42.50	39.10	1.10
Wheat	24.50	0.80	1.00	11.50	56.30	3.70

(Source: Nutritive value of Indian foods, NIN, 2007; MILLET in your Meals, <http://www.sahajasamrudha.org/>).

Table-5: Amylose & Amylopectin content of millets.

Cereal grain	Amylose (%)	Amylopectin (%)
Proso millet	28.2	71.8
Foxtail millet	17.5	82.5
Kodo millet	24.0	76.0
Finger millet	16.0	84.0
Sorghum	24.0	76.0
Bajra	21.1	78.9
Short Grain Rice	12-19	88-81
Wheat	25.0	75.0

(Source: MILLET in your Meals, <http://www.sahajasamrudha.org/>).

Declining small millet cultivation:

Even though millets have extraordinary nutritional qualities of grains and capacities of millet farming systems, the acreage under millet production has been shrinking over the last five decades. The period between 1961 and 2009 witnessed significant decrease in cultivated area under millets, more so in case of small millets (80% for small millets other than finger millet, 46% for finger millet). The area under all small millets other than finger millet has declined drastically in all states and the total production of small millets has declined by 76% and the productivity has remained more or less stagnant in the last two decades.