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Small Millets: Kodo and Kutki for Food and Nutrition Security in Naxals Affected Area of Chhattisgarh

Nishant Ghode
Department of Forestry and Wildlife, Shaheed Mahendra Karma Vishwavidyalaya, Bastar, Jagdalpur, Chhattisgarh

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Introduction

Millets are the oldest food known to mankind, and ranked as the sixth most important grain in the world sustaining one third of the world population. Bastar in Chhattisgarh is tribal dominated region where about 70% of the total population is tribes. Agriculture coupled with non timber minor forest produce (NTFP) collection is the major source of livelihood of these tribes. Bastar, the most deprived area in the country is rain fed and millets are the major crops of the region after rice. Accordingly, they form an important ingredient of household food security and nutrition particularly in draught years. Despite, the consumption of millet as direct food and area under this crop is declining continuously. The reasons for decline in the area and total production are low productivity, low price of the produce and ignorance of policy makers to extend the support. Besides, difficult processing of millets to convert them into convenient form for cooking or utilizing as food is cumbersome involving time and drudgery. On the other hand, the demand of processed millet foods or millet based foods has shown an increased trend in the urban markets due to inherent nutritional and medicinal characteristics of millets.

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Millets are a group of highly nutritious climate resilient small seeded grasses, widely grown around the world as cereal crops or grains for fodder and human food. Millets are particularly important crops in the semi-arid tropics of Asia and Africa, where they contribute to 97% of millet global production. Millet's productivity and short season under dry, high-temperature conditions make them a favourite among farmers in those environments. Generally, these are rain fed crops grown in areas with low rainfall and thus resume greater importance for sustained agriculture and food security.

Considering the importance of these nutritious small grain crops the U.N. General Assembly recently adopted a resolution, sponsored by India and supported by more than 70 countries, declaring year 2023 as the International Year of Millets. The resolution is meant to extend public awareness on the health edges of millets and their suitableness for cultivation beneath robust conditions marked by global climate change.

In general millets are rich source of fibre, minerals and B-complex vitamins. Yet, high fibre content and presence of some anti-nutritional factors like phytates and tannins in millets affect bioavailability of minerals.

Introduction

Bastar in Chhattisgarh is tribal region where about 70% of the total population is tribes. It is spread in 39.06 lakh ha area and about 63% of its area is under forest cover. The people of Bastar are very poor and their livelihood mostly depends on agriculture and forest produce. With typical land topography the agricultural operations of the region depends on rain fall. Paddy is the major crop of the area followed by millets and rightly the millets are the life line of these tribes. Though different types of small millets are grown in the region finger millet (ragi) occupies maximum area under cultivation followed by kodo and little (kutki) millets respectively. Millets are an important ingredient of household food security and nutrition particularly in draught years. Almost all the millets are cultivated using available landraces and without fertilizers as a result yields are very low in-spite of availability of responsive genotypes and promising technologies.

The recent COVID-19 pandemic has posed several challenges in various walks of life, adding to the hunger crisis already faced by millions worldwide. Did you know that in 2019, nearly 690 million people suffered chronic hunger globally? According to the United Nations Food and Agricultural Organization, the numbers are expected to rise. Moreover, the

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developing countries will be doubly hit, by hunger and diseases, besides the impacts of climate change on agriculture. Hence, ensuring food security, that is, reliable access to sufficient and nutritious food, aided by sustainable food supply chains, are the need of the hour.

Vernacular names of little & Kodo millets

English	Little millet	Kodo millet
Hindi	Kutki	Kodo
Sanskrit	-	Kodara
Kannada	Same	Harka
Tamil	Samai	Varagu
Telugu	Samalu	Arikelu, Arika
Malayalam	Chama	Varagu
Marathi	Sava	Kodra
Gujarati	Gajro, Kuri	Kodra
Bengali	Kangani	Kodo
Oriya	Suan	Kodua
Punjabi	Swank	Kodra
Kashmiri	Ganuhaar	-
English	Little millet	Kodo millet Hindi

Geographic 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 in coastal to 8000 feet altitude in Himalayas. The loss of area under finger millet has been less during the past 3 decades but with significant 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. Though more recent and accurate statistics regarding each of the small millets is lacking a broad picture is 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 rest by barnyard, foxtail and proso millets.

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Though small millets are grown in almost every state/region, the distribution of individual millet is not uniform. The kodo, and little millets are grown widely in Karnataka, Tamil Nadu, Andhra Pradesh, Orissa, Chhattisgarh, Bihar, Madhya Pradesh and Maharashtra. In Chhattisgarh, 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.

Physical properties and nutritional profile

The small millets are small seeded grains and resemble paddy or rough rice in the morphological features of kernel. The kernel consists of distinct husk, bran and endosperm tissues. 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 where as the other millets are grayish coloured. The husk is non-edible and unusually hard to digest similar to the husk in paddy, where as 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). 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. Millet grains are also rich in important vitamins viz., Thiamine, riboflavin, folin and niacin. Millets are comparable to rice and wheat or rich in some of the minerals as well as fatty acids. Millets vary largely in

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composition of carbohydrates as proportion of amylose and amylopectin content vary from 16-28% and 72-84%, respectively.

Nutrient composition of millets compared to others food grains (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)

Bioavailability of mineral nutrients from small millets.

As discussed earlier, millets have high levels of micronutrients especiallyminerals when compared to rice andwheat but on the other hand availabilityof these nutrients are limited by samefactors as that of cereals. These factorsinclude presence of inhibiting factorssuch as fiber and phytate, low levels ofabsorption enhancers make thenutrients less or unavailable to thebody. One of the important factorsidentified is phytic acid (Myo-

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inositolhexa phosphate), which occursabundantly in seeds including cerealsand millets. A meal containing 3 mg P(phytate) as IP6 would be expectedto reduce iron absorption by 20-30 percent 29.

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)

Millets as contributors of nutritional security in India

Millets are a group of diverse small-grain cereal crops grown in marginal soil and under stressed conditions. They comprise about a dozen crop species originated in Asia and Africa, primarily in the third world countries (Gopalan, 2009). India is the largest producer of millets producing nearly 40 percent of the world's millets despite much negative pressure from competing crops in terms of policies and production supports. Among several types of millets (pearl millet, finger millet, proso millet, foxtail millet, guinea millet, little millet, barnyard millet, etc.), pearl millet is the most common in India accounting for nearly 75

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percent of the total area devoted to millets. The millets' ability to adapt to adverse climatic conditions, requirement of minimal inputs, and superior nutritional qualities are among the specific characteristics of millets rarely found in other common cereals.

Millets are important sources of nutrients and can play a significant role in improving nutritional security and preventing diseases caused by imbalanced nutrition. They are gluten-free and contain as much protein as wheat does. In terms of macronutrients, millets are either similar or superior to major cereals. They also contain several micronutrients, vitamins, insoluble dietary fiber, and phenolic compounds, which are essential for health benefits. They are thought to have several health benefits including the ability to address diabetes, aging, cancer, celiac disease, and cardio-vascular disease. Millet-based health food items are common and exhibit longer storage life. Durairaj et al. observed a significant increase in height, weight, and hemoglobin level of the school children who regularly consumed millet-based health food (Indira and Naik, 1971). Even though millets are produced in adverse climatic conditions and can provide nutrition that otherwise are hard to find, their acreage continues to decline, and production and yield have stagnated. Between 1976 and 2016, India lost 44% of millet cultivation areas to other crops due to lack of policy support.

Millets have been neglected due to the following possible reasons. First, these crops are mostly used by low-income subsistence farmers living in arid or semi-arid regions of Asia and Africa, who have little aspirations and aim to produce more, rather than to increase the crops' quality. They also have limited access to technology due to several factors, such as limited education and finance. Second, millets are among the food choices of low-income households. Third, which is perhaps the most important reason, is the explicit lack of attention to millets both from researchers as well as from policy makers. Only recently, some attention has been paid to breed better yielding and higher quality varieties of millets, as staple foods in the PDS in some states of India.

Processing of millets

Although, millets have a better mineral profile than but the bioavailability of these minerals is low because of presence of some inherent anti-nutritional factors e.g. phytate, and polyphenols in grain. Several processing techniques malting, blanching, acid treatment have been developed to enhance food value and shelf-life of millet products and to improve the availability of starch, protein and minerals. A wide range of value-added products may be

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prepared from millet processed flour. In recent years, a variety of traditional and non-traditional, millet-based processed foods and complementary foods have been developed. These can become income- generation activity for women in household industry.

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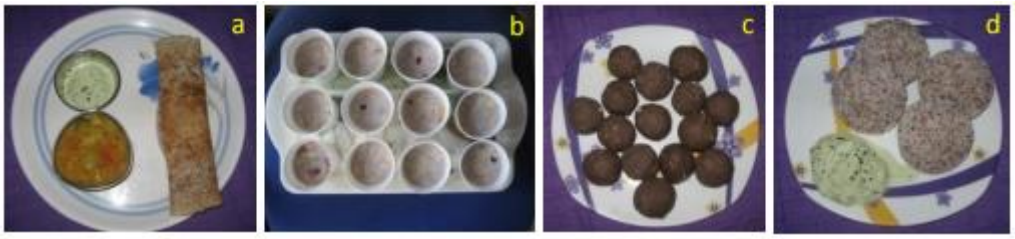

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Governmental policies

With respect to millets production/promotion, some of the existing Government schemes include

1. Initiative for Nutritional Security through Intensive Millets Promotion (INSIMP) – a part of Rashtriya Krishi Vikas Yojana" (RKVY) which is the only comprehensive initiative to support millet production.
2. Rainfed Area Development Programme (RADP) – a component of the Rasht Riya Krishi Vikas Yojana" (RKVY); and.
3. Integrated Cereals Development Programmes in Coarse Cereals based Cropping Systems Areas (ICDP-CC) under Macro Management of Agriculture (MMA).
4. In the 12th plan, our Government has recognized the role of millets in the food chain. Under the National Food Security Mission (NFSM), of the preliminary targets for enhancing food grain production by an additional 25 MT, the share allocated for millets is 2 MT (8% of the enhanced food grain production).

Future prospects

To ensure food and nutrition security, it is important to increase the production of these crops and simultaneously revert the control of production, distribution and consumption back to the people. Governmental support and institute incentives for rainfed farmers is needed to protect bio diverse millet based mixed farming system. Bring fallow and marginal land under millet cultivation. Multi-disciplenry scientific research is need of hour to develop new varieties and production technology to reduce gap between potential productivity and productivity in farmers' fields. Breeding strategies should be redesigned to orient product-specific cultivars. Increase demand of millets by: (i) Creating awareness regarding their nutritional and other health benefits, and environmental sustainability, (ii) Value addition (iii) The government should do partnership with research institutions and food companies to

develop new food products. (iv) Inclusion under feeding programme like mid-day meal, Integrated Child Development Services feeding, and adolescent girl's nutrition scheme etc.

Conclusions

Millets (Major and Minor millets) are dual purpose, nutrient dense, hardy and low input intensive crops that have potential to address malnutrition and climate change and can enhance export earnings. Additionally, millets are also rich in health promoting photochemical, and can be used as functional foods to protect against age-onset degenerative diseases. Their production potential can be achievable through supply side factors such as high yielding crop cultivars, nutrient management and integrated pest management and also by addressing demand side issues (value addition by processing, nutritional labeling, alternate industrial utilization and policy measures) so as to make millets cultivation more remunerative. With increased demand and profitability, we can inspire farmers to shift to millet cultivation even on better lands which are environmentally and nutritionally beneficial.

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