International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Millets for Sustainable Life: A Review on their Cultivation, Nutritional Properties and Value Added Products in India

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Abstract

According to an FAO report, millets are vital for sustainable agriculture. Production of millets in India was approximately 10 million tonnes in 2019, which is nearly 40% of the global share. Millets are classified as functional food due to their nutritional composition and the nutraceutical properties. The traditional knowledge about the functional and nutraceutical benefits of millets-based food items have been handed down through generations. Millet consumption has been reported in Indus-Sarasvati Civilization that dates back 3000 years ago. Some of the traditional millets that are cultivated and consumed include brown top millet (Urochloa ramosa), little millet (Panicum sumarense), kodo millet (Paspalum scrobiculatum), foxtail millet (Setaria italic), pearl millet (Pennisetum glaucum), jowar (Sorghum bicolor), finger millet (Eleusine coracana) and barnyard millet (Echinochloa esculenta). A lot of research has been carried out and the presence of micronutrients, phytochemicals and trace elements has been reported. Due to urban migration,rise in population and the subsequent need of catering to the growing population, the emergence of cereals such as rice and wheat led to the decline of the importance of millets. Now, again due to the persistent efforts to re-introduce millets as mainstream crop has gained positive results in the form of declaration of 2023 as 'International Year of Millets' and even the urban population in India preferring food items from millets. This is due to slow dispersal of knowledge about the nutritional composition of millets. Apart from this fact, millets can withstand extreme climatic conditions and can grow in harsh soil and are water-resilient crops. Around 154 varieties of millets have been released in India. Efforts have been made to encourage cultivation, production and distribution of millets with several incentives to farmers, investors, startup agencies, entrepreneurs, state agencies, stakeholders and exporters.

Keywords: millets, nutritional value, nutraceutical and functional properties, ancient millets, importance of millets cultivation

Introduction

India, well known for its agro-biodiversity and climatic zones has diverse crop cultivation practices. Previously nearly 80% of the population lived in villages and traditionally, millets were grown across the country; but in the name of development, migration took place to urban areas and the millets were put on the backburner. Cereals such as rice and wheat now occupy the centre-stage. The importance of the goodness of millets can be understood from the very fact that the United Nations General Assembly

(UNGA) adopted a resolution declaring the year 2023, as the 'International Year of Millets', aimed at raising awareness of the nutritional properties and health benefits of millets and their climate-resilient properties. Millets are cereals, traditionally cultivated and consumed by low-income group farmers and those who knew about the significance of these underutilized crops. Large-scale cultivation and promotion of millet consumption could help to meet the sustainable development goals such as 'attaining zero hunger', 'end hunger', achievement of food security and improving nutrition and promotion of sustainable agriculture [1]. Most of the millets have evolved to thrive in diverse environment. Due to climate change, increasing population and unreliability of vegetables, the researchers and policy makers are currently focused on millets as most of them can survive in extremely harsh conditions, without any need of human intervention. Millets are now considered as environmentally, economically and ecologically friendly sources of food and nutrition [2].

Evidences of cultivation of C4 crops such as maize, sorghum and sugarcane during Indus Valley Civilization to combat water stress and adoption of crop water management practices as an agricultural strategy at sites such as Harappa, Kanmer, Shikarpur and Alamgirpur have been reported [3]. Millets contain high amount of proteins, fibre, B-complex vitamins, micronutrients, trace elements, phyto-nutrients including phytic acid that have the capacity to lower cholesterol and phytate, which are associated with reducing the risk of cancer [4]. According to Food and Agriculture Organization of the UN, millets are 'collective group of small seeded annual grasses that are grown as grain crops, primarily on marginal land in dry areas of temperate, sub-tropical and tropical regions [5]. As of 2019, Africa is the largest producer of millets (both in area and production wise). India produces more than 170 lakh ton (nearly 80% of Asia's and 20% of global production). The global average yield of millets is 1229 kg/ha. In India, the top five states that produce millets are Rajasthan (bajra / sorghum), Karnataka (jowar / ragi), Maharashtra (ragi / jowar), Uttar Pradesh (bajra) and Haryana (bajra). Other millets such as Tef (*Eragrostis tef*) and Fonio (*Digitaria exilis*) are grown in countries such as Ethiopia, Eritrea, Australia, West Africa, Sudan, Nigeria, Togo, Senegal and Mali for food grain and fodder.

History of Millet Cultivation and Consumption in India

According to the International Crops Research Institute for the Semi-Arid Tropics, millets cultivation has been reported dating back to the middle Jeulmun pottery period (about 3500 – 2000 BC) in Korea. In Sanskrit, the iron-rich ragi is referred to as '*nrtta-kondaka*' (dancing grains). There is a legend that maintains that Lord Rama, Indra and Hanuman preferred ragi over rice due to its richness in minerals, amino acids and for being gluten-free meal. Millets are mentioned in the Oldest *Yajurveda* texts – foxtail millet *(priyangava),* barnyard millet *(aanava)* and black finger millet *(shyaamaka)*, dating back to Indian Bronze Age (4500 BC) [6]. Millets were consumed in the Indus – Sarasvati civilization (3300 – 1300 BCE) [7]. A report shows that some species of millets were found at Surkotada (an archaeological site in Gujarat) – ragi, sorghum and amaranth grains [8]. Apart from millets, there are many underutilized crops like amaranth grains, buckwheat, winged bean, faba bean, rice bean, kalingada, guayule, tumba, jojoba, kankoda and jatropha [9]. The *Kalpasutra*, mentions various food grains such as rice, barley, wheat, millet, sesame and pulses. Also,the various climatic zones, availability of river water and fertile land, agro-biodiversity prove to be a boon to India. In general, millets belong to the family *Poaceae*.

Advantages of growing / consuming millets include: growth in areas of stressed-climate with unfertile soil; rich source of nutrients, fibre and minerals; gluten-free nature; traditional crops which are superior to wheat and rice [10]. When consumed with select vegetables / underutilized fruits and vegetables,

millets are nutraceuticals with the potential to cure many health-related problems. These millets contain several bioactive compounds that play a major role in our nutritional health aspects. Some of the bioactive compounds that have been reported to be present in these millets include amines (NH_2 & N-H), alkanes (C-H), anhydrides (C=O), esters (P-OR), silanes (SI-OR), phosphonates (P=O), oximes (=NOH) (C=N), Nitro (N=O), Sulfoxide (S=O) etc. [11]. According to a study [12], archaeo-botanical evidences for little millet as a staple crop of Proto-historic Gujarat has been retrieved; also, it was a crop of the eastern Harappan zone by the Ravi Phase at Harappa. In South India, browntop millet was the first staple millet and the early crop / resource in the Neolithic Ganges. Reports of kodo millet occurred on the peninsular sites of Iron Age or Early Historic period. There is evidence that two millets – browntop and foxtail were cultivated since Neolithic times in South India. Cultivation of single millet species during the Late Proto-Dravidian and five millets during Proto-South Dravidian period have also been reported. Before 1965, millets accounted for around 40% of all the grains grown; after India's Green Revolution, rice and wheat production have doubled and tripled and the millets cultivation / growth have been considered primeval [13].

A report shows that in South India, farming started around 5000 years ago; in the Southern Neolithic, villagers grew dry-farmed millets such as *Brachiaria, Setaria verticillata* and *Echinochola* along with *Vigna radiata* and *Macrotyloma uniflorum.* The later period reported the domestication of *Eleusine coracana* and *Sorghum bicolor.* Domestication of *Pennisetum glaucum* in the archaeological contexts in North Karnataka were reported [14]. The prayer offered to Lord Muruga in Tamil starts with the words *'Thaenum Thinai Maavum'* (I offer honey with Thinai flour i.e., foxtail millet). In the olden days, villagers called millets as *'pasithaangi'* ('hunger bearer', i.e., we may not feel hungry or tired for a long time after eating food made from millets) [15]. There are quotes from ancient Tamil literature – *Purananuru* (poem 327) about how a peasant relieves the poverty of his relatives, by obtaining low yielding kodo millet on loan; another *Purananuru* poem 333 depicts the miserable life of a poor peasant who spent all the common millet by serving millet meals to the bards. Here, the housewife of the peasant did not want to send his guest with hungry stomach and hence they both cooked clusters of millet preserved as a seed for sowing. Another Tamil poem – *Tholkappiyam* mentions eight kinds of foods – paddy, horse gram, kodo millet, great millet, foxtail millet, little millet, forage and wheat. In *Perumpaanatruppadai* (poem 193), a verse mentions a recipe made of millet as 'sweet tasting meal made with little millet'. In *Malaipadukadam*, another poem mentions millet as 'every day dishes made with fine millet flour mixed with sifted sugar powder' [16]. The 32nd song of *'Thani Padal Thirattu'* by Poet Avvaiyar describes an indigenous meal as 'steamed varagu rice, smoked and mashed aubergine and tangy frothy buttermilk' and expressed her gratitude to her host – *Boothan* of Pulvelur village [17]. *'Palliadutal'* and *'Taliadittal'* are some of the tools and techniques mentioned in *Purananuru* in which *Pudu Varagu* (new millet), sesame and field beans are raised in *Kurinji* area [18]. The following image shows the traditional millets grown and consumed throughout the country [19].

Figure. 1: Traditional millets cultivated and consumed in India

Use of plants by people of Alamgirpur over the Mature Harappan, Late Harappan and Painted Grey Ware (PGW) phases and a mixed phase of Late Harappan-PGW material has been reported. Grain pulses, wide range of plant taxa, clovers and other members of *Fabaceae* were detected at many northeast Indus sites. Also the sites show that people used a diverse spectrum of seeds and plants in all the phases [20]. Millets and pulse foods were an important part of the culinary tradition during the Southern India Iron Age, which was evident from the food lumps analysis at a site – Kadebakele (Karnataka); also the longevity of culinary practices – especially millets – can be studied from food lumps [21] . It is reported that jowar and bajra were the two main millets cultivated during the Mughal period. Till 17th century, it was believed that maize (*makai / makka*) was not known in India; but, there are works that establish the growth of maize in Rajasthan and Maharashtra in the second half of the 17th century. Some of the factors for the decline in millets cultivation and consumption in India include rapid urbanization, changing tastes of the consumer and preferences due to rising per capita income, favoring other crops, supply of rice and wheat at cheaper prices, poor social status and inconvenience in growing them and lower shelf life of milled grain and flour of millets [22]; supply-led factors include increasing marginalized cultivation, low profitability / low remuneration for millets vis-à-vis competing crops, more remunerative crop alternatives in kharif competing with millets, lack of incentives for millet production, decline in production and quality (poor quality of grains due to blackening of grains of

sorghum that fetch very low price for the farmers) [23]. Table 1 shows the Old World millets cultivated in India [12].

Table 1: Old World Millets cultivated in India

Species	Common name	Region of origin and cultivation
Brachiaria ramose (L) Stapf.	Browntop millet, pedda-sama	South India
Coix lachrymal – jobi L.	Job's tears (taxonomically closer to maize)	Northeast India, southeast Asia
Digitaria cruciate (Ness)	Raishan	Khasi Hills, Assam
Digitaria sanguinalis (L) Scop.	Harry crabgrass	Cultivated in Kashmir; also cultivated in Himalayas
Panicum miliaceum L ssp. *Miliaceum*	Proso millet	Throughout south Asia
Panicum sumatrense Roth. Ex. Roem. And Schult Subsp. *Sumatrense* (syn. *P. miliare* auct.pl.)	Little millet, samai	India, especially peninsula
Paspalum scrobiculatum L	Kodo millet	India, especially peninsula and Himalayas
Pennisetum glaucum (L) R. Br (= *P. americium* (L) Leeke)	Pearl Millet	Cultivated throughout India
Setaria italic (L), P. Beauv ssp. *Italic*	Foxtail millets	Throughout South Asia and in parts of Southeast Asia
Setaria pumila (Poir.) Roem and Schult (syn. *S. glauca* auct pl.)	Yellow foxtail millet, Korali	India (domesticated populations reported)
S verticillata (L) P. Beauv.	Bristley foxtail millet	South India (domesticated populations)
Sorghum bicolor (L) Moench. ssp. *bicolor*	Sorghum, jowar	Cultivated throughout South Asia

According to Assocham data, millets are rich in various nutrients such as dietary fibre, calcium, fat, protein, trace elements and micronutrients. Although millets were widely cultivatd in the ancient era, they lost their importance with time and now, they are grown as marginal crops catering to the nutritional requirements of a limited population / indigenous tribes.

Tamil Nadu scenario

Almost 91% of the total land holdings in Tamil Nadu belong to small and marginal farmers and agriculture is the major livelihood provider. Almost 80 – 90% of the groundwater has been over-exploited. In order to boost sustainable dry-land agriculture, initiatives such as cluster-based approach, comprehensive land development, encouraging agronomical interventions, animal husbandry activities, value addition and enabling custom hiring centres have been taken as a mission. Other subsidies such as

production subsidy, distribution subsidy, cluster demonstration, micro-nutrient mixture distribution, biofertilizer distribution, value addition training to farmers, strengthening of millet farmer producer organization etc. also have been implemented (Department of Agriculture, Government of Tamil Nadu, 2017). At present, sorghum is cultivated in western districts, parts of central districts and southern districts in Tamil Nadu. Pearl millet is cultivated mostly in central and southern districts. Finger millet is cultivated in western districts. Maize is cultivated in western, southern and central districts. Barnyard millet is in southern districts; kodo millet in delta and central districts; little millet in northern and western districts; foxtail millet and proso millet in western districts. In order to enhance the millet production, two 'Millet Special Zones' have been created by the 'State Mission on Millets' Department. The north zone comprises 10 districts and the south zone, 12 districts. Here, there are several Farmers Producer Organizations (FPOs) of millets, their address and contact details for the consumers' benefit. Also there are several startup agencies / entrepreneurs and exporters that are involved in cultivation / production / distribution / procurement of seeds and the crops as a whole. Apart from these, Agricultural and Processed Food Products Export Development Authority (APEDA), Directorate of Agriculture, Government of Tamil Nadu, The National Institute of Food Technology, Entrepreneurship and Management – Thanjavur (NIFTEM-T), Tamil Nadu Agricultural University and Technology Business Incubator (TNAU) etc. are some of the stakeholders / state agencies. Tables 2 and 3 show the nutritional value of millets [24, 22].

Table 2: Nutritional value of millets

Nutrients	Types of millets	Nutritional value
Calcium	Finger millet – ragi	364 mg
Fat	Pearl millet	5.43 g
Protein	Proso millet	12.50 g
Dietary fibre	Pearl millet	11.49 mg
Magnesium	Proso millet	153 mg
Zinc	Barnyard millet	3 mg
Iron	Pearl millet	6.42 mg
Iron	Barnyard millet	5 mg
Folic acid	Kodo millet	39.49 µg
Folic acid	Sorghum	39.42 µg

Table 3: Nutritional value – including trace elements and micronutrients in millets

Grain	Nutrients					Micronutrients					Vitamins			
	Carbohydrates (g)	Protein (g)	Fat (g)	Energy (Kcal)	Dietary fibre (g)	Ca (mg)	P (mg)	Mg (mg)	Zn (mg)	Fe (mg)	Vit. B1	Vit. B2	Vit. B3	Vit. B9
Sorghum	67.7	09.9	1.73	334	10.2	27.6	274	133	1.9	3.9	0.35	0.14	2.1	39.4

Pearl Millet	61.8	10.9	5.43	347	11.5	27.4	289	124	2.7	6.4	0.25	0.20	0.9	36.1
Finger millet	66.8	07.2	1.92	320	11.2	364.0	210	146	2.5	4.6	0.37	0.17	1.3	34.7
Kodo millet	66.2	08.9	2.55	331	06.4	15.3	101	122	1.6	2.3	0.29	0.20	1.5	39.5
Proso millet*	70.4	12.5	1.10	341	-	14.0	206	153	1.4	0.8	0.41	0.28	4.5	-
Foxtail millet*	60.1	12.3	4.30	331	-	31.0	188	81	2.4	2.8	0.59	0.11	3.2	15.0
Little millet	65.5	10.1	3.89	346	7.7	16.1	130	91	1.8	1.2	0.26	0.05	1.3	36.2
Barnyard millet*	65.5	06.2	2.20	307	-	20.0	280	82	3.0	5.0	0.33	0.10	4.2	-
Wheat flour	64.7	10.6	1.47	321	11.2	39.4	315	125	2.8	3.9	0.46	0.15	2.7	30.1
Rice	78.2	07.9	0.52	356	02.8	07.5	96	19	1.2	0.6	0.05	0.05	1.7	9.32
Amaranthus seeds	61	13.3	5.6	356	7.5	162.0	412	270	2.8	8.0	0.04	0.04	0.52	24.7
Quinoa	54	13.1	5.5	328	14.7	198.0	212	119	3.3	7.5	0.83	0.22	1.7	173

Cultivation and growth

Since millets are rainfed crops, specific irrigation pattern is not required and they can grow in or withstand drought-like conditions. Millets can grow on skeletal soils that are less than 15cm deep. Soil rich in minerals is not required, since millets do not require such soil for survival and growth. They grow both in acidic and alkaline soils. Low income group farmers may benefit from millets, especially farmers in dryland areas. Apart from food and fodder, the residues from sorghum and pearl millet are also used as domestic construction materials, fuel etc. [25]. The table 4 shows the production of few of the millets in India from 2017 – 18 to 2020 – 21 (as on September 2020) [26].

Table 4: Production of millets (in million tonnes) in India from 2017 – 18 to 2022 – 23

In million tonnes

Crop	Season	2017 – 18	2018 – 19	2019 – 20	2020 - 21	2021 – 22		2022 - 23
						Fourth Advance Estimates	Target	First Advance Estimates
Jowar	Kharif	2.27	1.74	1.70	1.99	1.59	3.00	1.69
	Rabi	2.53	1.74	3.08	2.83	2.64		
	Total	4.80	3.48	4.77	4.81	4.23	3.00	1.69
Bajra	Kharif	9.21	8.66	10.36	10.86	9.62	11.30	9.75
Maize	Kharif	20.12	19.41	19.43	21.56	22.63	23.10	23.10
	Rabi	8.63	8.30	9.34	10.09	10.99		
	Total	28.75	27.72	28.77	31.65	33.62	23.10	23.10
Ragi	Kharif	1.99	1.24	1.76	2.00	1.70	2.50	1.60
Small Millets	Kharif	0.44	0.33	0.37	0.35	0.37	0.70	0.42

Value added products from millets

Ready-to-eat snacks, bakery products, ready-to-cook products, instant mixes, millet flour etc. are some of the value added products from millets. Traditional recipes as breakfast food, snacks and sweets have become common due to their varied taste from the regular items and for their nutritional value. Products that are liked by children are also prepared with the millets, e.g., pasta meals, vermicelli, noodles, macaroni, flaked and popped millets, instant food mixes, expanded products, extruded products, decorticated ragi, ragi-based snack items, ragi-soup mix, seed-coat based snacks, malt beverages, malted weaning food, ready-to-cook or ready-to-eat products, malt-based infant foods, enteral food, convenience flour (flour mixed as per our requirement / wish / convenience), husk-free flour, fermented products and health/nutri-bars (chocolates) etc. are prepared [27].

Other ancient grains

Many of the ancient grains such as true cereals (millets and wild rice), pseudocereals (amaranth, buckwheat, quinoa etc.) and pulses (bean, groundnut, lupins etc.) contain starch and protein as their major nutrients and high levels of phytochemicals, Vitamin B and minerals. These are generally underutilized food resource, but due to lack of awareness, yield potential of ancient grains is lagging behind the major crops all over the world. Ancient grains are very well known for their capacity to produce a crop with minimal inputs and at present, hybrid cultivars of ancient grains are increasingly developing. Reports suggest that there are substantial success with mineral biofortification of sorghum and pearl millet. Apart from being nutraceuticals, phytochemicals present in the ancient grains have effects of reducing glycemic response, slow gastric emptying, reducing protein glycation and hypertension [28]. The table 5 shows the nutritive value of some of the ancient grains and underutilized millets such as teff, fonio and black rice [29 - 32].

Table 5: Nutritional components in ancient grains and underutilized millets

Grains	Starch (g/100g)	Protein (g/100g)	Dietary fibre (g/100g)	Fat (g/100g)	Ash (g/100g)	Ca mg/100dm	Mg mg/100dm	P mg/100dm	K mg/100dm	Fe mg/100dm
Amaranth	61.4	16.5	20.6	5.7	2.8	32.7	207	384	555	4.7
Buckwheat	70.6	12.6	10.0	3.1	1.8	49.7	250	No data	No data	No data
Quinoa	57.18	12.18	12.75	7.73	2.72	32.9	230	442	927	5.4
Teff (*Eragrostis tef)*	74	10.0	8.0	2.1	2.6	161	177	384	378	11.6
Fonio (*Digitaria* sp.	75	8.4	18.2	2.6	3.4	38	415	195	160	11.4
Lupins (*Lupinus*)	9.4	39.6	38.9	8.8	3.3	84	189	No data	810	4.9

Teff is high in flavonoids (mg/100g), phenolic acids such as ferulic acid, procatecheric, *p*-coumaric acid, catechin, rutin, quercitin, resveratrol etc. Fonio is rich in flavonoids, *trans*-ferulic acid, procatecheric acid, luteolin and epigenin. In lupins lutein, genistein, lupanine, lupinine, sparteine, gramine etc. are present, but they vary among the species. The table 6 shows the phytochemicals present in the millets [33].

Table 6: Phytochemicals in millets

Millets	Tannins	Flavonoids (mg/100g)	Phenolic acids (mg/100g)	Health aspects
Finger millet	White and red, none Brown, some varieties—(600–2100 mg/100 g)	High levels Soluble: 210 Insoluble: 1	Low levels Soluble: 17 Insoluble: 52 (trans-Ferulic acid, taxifolin, vitexin, tricin, luteolin etc.)	Antihyperglycemic effects Antiinflammatory
Barnyard millet	None	Low 29–58	Total phenolics: 29–80 (Ferulic acid, Vanillic acid, Sinapic acid, Naringenin etc.)	Antihyperglycemic and hypolipidemic effects
Foxtail millet	None	Generally low	High levels	Antihyperglycemic

		levels 25–88 Soluble: 25 Insoluble: 2	Soluble - 63 Insoluble- 181 (*p*-Coumaric acid, Catechin, Apigenin, Kaemferol etc.)	and hypolipidemic effects
Japanese barnyard millet	No data	No data	Luteolin, tricin, Biochanin A, Kaempferol etc.	No data
Kodo millet	None	Low levels? Soluble: 13 Insoluble: 38	High levels Soluble: 95 Insoluble: 379 (Kaempferol, Apigenin, Luteolin, Isovitexin etc.)	-
Little millet	None	Both low and high levels: 87 and 335 Soluble: 87 Insoluble: 0	Intermediate levels Soluble: 67 Insoluble: 136 Total phenolics: 430 (*p*-Coumaric acid, Vanillic acid, Apigenin)	
Pearl millet	None	Low levels Soluble: 6 Insoluble: 1	Intemediate levels Soluble: 58 Insoluble: 100 (*trans*-Ferulic acid, Epigenin, Myricetin etc.)	Goiterogenic effects
Proso millet	None	Generally low levels 8-51 Soluble: 5 Insoluble: 3	High levels Soluble: 50 Insoluble: 208 (Kaempferol, Apigenin, Myricetin etc.)	Serum cholesterol improvement
Red Wheat (reddish hued husk of wheat)	None	Generally Low levels Soluble: 2 Insoluble: 33 Total 11	Low levels Total: 68–78 (Ferulic acid, diferulic acid, *o*-Coumaric acid	Contains gluten

			etc.)	

Millets in future

In 1965, All India Coordinated Millet Improvement Project (AICMIP) was established, which has played an important role in developing a diverse range of improved breeding lines and parental lines of hybrids in commercializing a large number of hybrids. Due to their properties contributing good health, cultivation and benefits for the farmers, millets can be a feasible alternative for the cereals. Another positive aspect is low water footprint required for the cultivation of millets; millets have been proven to sustain in water-scarce areas that are dented by extreme groundwater extraction. From 2014 to 2021, nearly 154 varieties of millets have been released in India (Sorghum – 43; pearl millet – 52; little millet – 11; proso millet – 4; kodo millet – 4; finger millet – 28, foxtail millet – 8; barnyard millet – 4). ICAR and IIMR are encouraging farmer producer organizations; schemes such as Production Linked Incentive (PLI) are being supported to enhance the value addition. Encouragement from general public can help millets regain market share and create additional opportunities for small-scale farmers. As per a report, the Confederation of Indian Industry has made millets a key focus area for awareness creation, market exploration and capacity building [34]. Preparation of millet-based products and marketing may be challenging; but marketing options may be viable for ready-to-cook or ready-to-eat recipes.

Sustainable production of millet crops has been achieved by AICRPs on small millets, sorghum and pearl millet. After the United Nations declaration as 'Year of Millets', there has been a considerable comeback by millets and farmers all over the country are encouraged to cultivate millets with several incentives. The government is trying to make millets a mainstream crop, in order to achieve a balanced lifestyle with a balanced diet. Currently, millets account for less than 3% of the global grains trade; in case of volatile situations in markets such as price escalation, monsoon failure, regression, natural calamities, wars etc., millets can provide a valuable alternative to other grains. Due to the mounting population pressure, millets may become a staple in household in 2025 (Banerjee, 2023). The government empanelled Group of Ministers, core committee members, task forces, logos, slogans, convention of stakeholders, action points etc. are some of the initiatives by the government for enhancing the productivity, cultivation, marketing and creation of awareness about the nutritive value of millets (Ministry of Agriculture and Farmers Welfare (2022)). Ancient grains, along with millets can be cultivated for biofortification – breeding of crop varieties with high levels of micronutrients. Low-glycemic index noodles, pasta, snacks are some of the food products of the future to combat non-communicable diseases such as cardiovascular diseases, respiratory ailments and diabetes.

Acknowledgement

The authors are grateful to the C P R Environmental Education Centre, Chennai for providing the necessary support to carry out the manuscript work.

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