

Promoting Millets: Charting a Journey from Food Security to Health

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Abstract

Millets have been the staple food in many parts of the world, but in recent times they have been losing ground because of the increased use of processed foods and grains, such as wheat and rice. India has been the granary of millets due to the largest production and export of Indian millets globally. The very nature of millets being drought-resistant, small seeded grass, which can be grown in arid conditions, with less water and less farming intensive, makes it a great choice for ecological agriculture and sustainable source of food for combating hunger in the rapidly changing global climate and constructing climate-resistant agri-food systems. The various health benefits of millets make them an excellent choice for patients with celiac disease, type 2 diabetes mellitus, ischemic heart disease, dyslipidemia, obesity, etc.

Keywords: Cardiovascular disease, diabetes mellitus, food security, health benefits, IYOM 2023, millets, sustainable agriculture

INTRODUCTION

Millet is a type of grain that is popularly consumed in many parts of the world and is a staple food in Africa and Asia. According to the World Food Programme, there are an estimated 1.2 billion people who consume millet as part of their diet. The majority of the millet production in the world is in Africa, followed by Asia.^[1]

Millets have been called various names, such as “Mota Annaj,” “Nutri-cereals,” “coarse cereals,” and “cereals of the poor”. The latest addition to this list of names is “Shree Ann—the mother of all grains,” coined by the Finance Minister of India, Mrs. Nirmala Sithrman, during her budget speech on February 1, 2023, and also announced that the Indian Institute of Millets Research (IIMR) at Hyderabad would be converted to the Centre of Excellence.^[2]

Indian millets are a group of nutritiously rich and drought-tolerant plants and are mostly found in the arid and semiarid regions of India. They are small seeded grass belonging to the botanical family “Poaceae” and are an important source of food and fodder for millions of resource-poor farmers and play an important role in the economic security of India. In 2018, India declared millets as “Nutri-cereals” and introduced them in “Poshan Abhiyaan” in an effort to alleviate malnutrition and micronutrient deficiency among the poor. This emphasis on

millets led to increased production (27% growth) of millets in 2021–2022.^[1]

India is the largest producer and exporter of cereal products in the world. India’s export of cereals stood at Rs. 96,011.42 crore/12,872.64 USD millions during 2021–22. Rice (basmati/non-basmati) has the major share (75%) in India’s total cereals export, whereas wheat represents only about 25% of the total. India is also one of the top 5 exporters of millets in the world. The world export of millets increased from \$400 million in 2020 to \$470 million in 2021 (International Trade Centre trade map). India’s export of millets was worth \$64.28 millions in 2021–22 against \$59.75 millions in 2021–2022.^[1] According to a Press Information Bureau (PIB) report, the production of millets has increased from 14.52 million tons in 2015–16 to 17.96 million tons in 2020–21.^[3]

Millets have been the staple food in India for centuries, but over the years they have been in less demand and they

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have been losing importance as a source of food due to the increasing demand for rice, wheat, and other processed food. Jowar (sorghum), bajra (pearl millet), and ragi (finger millet) are the three main millet crops that are currently being grown in India. India also produces a wide variety of indigenous, biogenetically diverse “small millets,” such as kodo, kutki, chenna, and sanwa. Rajasthan, Andhra Pradesh, Telangana, Karnataka, Tamil Nadu, Maharashtra, Gujarat, and Haryana are the major producers of millet in our country.^[1] These states have a larger number of millet farmers who grow millets for both domestic and international markets.

Food security

Millets are a group of staple food crops in India and play a significant role in food security, especially for the rural and poor populations. Millets are highly nutritious and are capable of providing food security to people in areas where other crops cannot be grown easily due to harsh climatic conditions. They are hardy and drought-resistant and can be grown in marginal soils and regions with low rainfall, making them a reliable source of food even in challenging environmental conditions and ideal for farmers in such regions. Additionally, millets are also capable of being stored for long periods, which is important for food security in times of scarcity.^[1,4] Overall, millets are a crucial component of food security in India and their revival can contribute to the sustainable development of the country’s agricultural sector.

The global community has been faced with numerous challenges and threats to food security in recent times due to the coronavirus disease 2019 (COVID-19) pandemic, recent economic recession, and Ukraine–Russia war. Food security is a serious issue during these times as there are disruptions to the food supply chain, concerns about shortage of essential goods, rising prices, and the impact on vulnerable populations. Millets can become of paramount importance in safeguarding food security during these critical times by diversification of crops that farmers grow and removing dependency on a single crop. This can help increase food security by ensuring that there are alternative sources of food in case one crop fails. Millets being highly nutritious may help address the issue of malnutrition prevalent in many regions of the world. Millets are tough and affordable and can be grown with minimal inputs, which can provide a source of income for small farmers and can help improve their economic conditions during times of economic recession. Millets are also drought resistant, making them an excellent choice to withstand the effects of climate change. This guarantees that farmers and locals have enough food even during extreme weather events. Economic recession makes the population vulnerable due to increasing unemployment, decreasing household incomes, and rising food prices. As millets are locally available and low cost food source, they are very relevant during are very relevant during unprecedented or vulnerable times.

Sustainable agriculture

The cultivation of millets requires less water compared with

other crops, making them ideal for regions with water scarcity. Millets are highly adaptive to a wide range of ecological conditions, which thrive well in rain-fed, arid climate but can also be grown in mountainous, low-fertility, dry, rain-fed, and tribal areas.^[1] It requires less labor-intensive cultivation, has shorter cultivation cycles, and is beneficial to the soil. Millets can be a long-term source of income for farmers due to low investment requirements. Millets are also used as fodder, which makes it more farming efficient. They also require fewer inputs, such as fertilizers and pesticides, making their production more sustainable and environmentally friendly. The promotion of millets can contribute to a reduction in the carbon footprint, making it an environmentally conscious food choice.^[5] Millets are the world’s answer to a sustainable source of food for combating hunger in the rapidly changing global climate and constructing climate-resistant agri-food systems.^[5]

Health benefits of millets

There are several types of millet grown in India, each with its unique nutritional profile. Indian millets are nutritionally superior to wheat and rice as they are gluten free and rich in fiber, minerals (iron, zinc, folate, phosphorous, copper, calcium, etc.), vitamins, and antioxidants, making them ideal for people with celiac disease and gluten intolerance.^[6] They have a superior micronutrient profile and are rich in bioactive flavonoids. They are also beneficial for people with type 2 diabetes mellitus as they have a low glycemic index, which helps in controlling blood sugars.^[7] Millets are also beneficial for people with heart diseases as they contain magnesium, which helps in reducing hyperlipidemia and thus the risk of heart diseases. They also help in reducing weight and reduction in blood pressure.^[1,6] In India, we usually consume millets with legumes, which creates a mutual supplementation of protein, increases amino acid content, and enhances the overall digestibility of proteins.^[7] Table 1 lists the nutritive value of various millets, and Table 2 enumerates a few common millets and their health benefits.^[7-11]

International year of millets (IYOM) 2023

The IYOM 2023 is a global initiative by the Food and Agricultural Organization of the United Nations (FAO) to raise awareness about the importance of millets as a food crop and to encourage the production and consumption of these crops.^[12] India has been the granary of millets with an estimated share of around 41% of the global production, and it was but natural for India to intensify its effort to revive the significance of millets and promote their consumption. Hence, the Indian government had suggested to the United Nation for declaring 2023 as the “International Year of Millets” (IYOM 2023). India got the support of 72 other countries, and on March 5, 2021, the United Nations General Assembly (UNGA) declared 2023 as the IYOM.^[13] The aim of IYOM 2023 is to create awareness about the numerous health benefits, improve food security, and support sustainable agriculture. The Indian government has also established the National Millet Mission to support this cause. IYOM 2023 provides an opportunity for India to showcase its expertise in millet cultivation and processing and to promote

Table 1: Nutritive value of various Indian millets^[10,11]

Type of millets	Protein (gm)	Fat (gm)	Carbohydrates (gm)	Dietary fiber (gm)	Iron (mg)	Calcium (mg)	Others
Sorghum (jowar)	10.00	1.70	68.72	10.20	3.95	27.60	Rich in antioxidants and anti-inflammatory compounds
Pearl millet (bajra)	11.00	5.40	62.35	11.50	8.00	42.00	Rich in magnesium and phosphorous
Finger millet (ragi/nachani)	7.20	1.90	67.35	11.20	4.62	364	Rich B complex vitamins
Foxtail millet (korra/kangni/rala)	12.30	4.30	60.09	-	2.80	31.00	
Porso millet (barri/variga)	12.50	1.10	70.04	-	0.80	14.00	Rich in antioxidant compounds
Barnyard millet (jhangora)	6.20	4.40	65.55	-	5.00	20.00	
Kodo millet (varagu/koden/kodra)	8.90	2.60	67.38	6.40	2.34	15.27	
Little millet (kutki/sama)	10.40	3.90	66.84	7.70	1.26	16.06	Rich in antioxidants and anti-inflammatory compounds

the health and nutritional benefits of these crops to a wider audience.^[14] The Indian government and other stakeholders can also use this opportunity to revive the cultivation and consumption of millets and increase global production of millets, which can contribute to the sustainable development of the country's agricultural sector and help to ensure an increased contribution of millets to food security for its population. The Indian government also aims to increase the acceptability of the "value addition of millet" across the country and the world.

Millets and benefits to the Indian economy

Millets have several benefits to the economy of India like

1. Job creation: The cultivation, processing, and marketing of millets can create new jobs in rural areas, especially in farming communities, and help to reduce poverty and improve rural livelihoods.
2. Increased agricultural production: The promotion of millet cultivation can increase agricultural production and provide a reliable source of food for the population, especially in regions that are prone to drought and other climatic conditions that affect other crops.
3. Improved food security: Millets are a nutritious and drought-resistant food crop that can help to ensure food security for the population, especially in regions where food shortages are common.
4. Improved trade: The increased production and consumption of millets can lead to increased trade, both within the country and internationally, as demand for these crops grows.
5. Reduced import dependence: The promotion of millet cultivation and consumption can reduce the country's dependence on imported food products and help to promote self-sufficiency in food production.
6. Boost to the rural economy: The cultivation, processing, and marketing of millets can provide a boost to the rural economy and help to improve the standard of living for rural communities.

Overall, the promotion of millets can provide multiple benefits to the economy of India, including increased agricultural production, improved food security, increased trade, reduced import dependence, and boost to the rural economy.

Initiatives taken by the government for promotion of millets

The Indian government has taken several initiatives to promote the production and consumption of millets in India. They also focus on making them a more accessible and nutritious food option for the general population. Some of these initiatives include^[1,12-14]:

- National Food Security Mission (NFSM): The NFSM aims to increase the production and productivity of millets in India, with a focus on rain-fed areas.
- Price Support Scheme: The government provides a minimum support price (MSP) for millets to encourage farmers to grow and sell these crops.
- Promotion of Millets in the Public Distribution System (PDS): The government has included millets in the PDS to make them more accessible to the general public and to ensure a steady market for produce.
- National Initiative on Millets: The government has launched a national initiative to promote millets and increase their consumption. This includes providing information on their nutritional benefits and conducting demonstrations on the preparation of millet-based foods.
- Setting up of Millet Parks: The government has set up millet parks in various states to promote the production and processing of millets.
- Setting up of the National Millet Museum: The government has set up the National Millet Museum in Hyderabad to promote awareness and understanding of millets.
- Making seed kits: The government has made seed kits and other inputs available to farmers, which is helping in building value chains through Farmer Producer Organizations (FPOs) and has made millets more marketable.
- Setting up Nutri-Gardens: The Ministry of Women and Child Development has been establishing Nutri-gardens, promoting research on the connections between crop diversity and dietary diversity, and running a behavior change campaign to increase consumer demand for Nutri-cereals.

Table 2: Health benefits of various Indian millets^[7-11]

Diseases	Elements that lead to benefits	Translated health benefits	Millets mainly helpful		
Cardiovascular disease	Rich in magnesium	Decreases blood pressure Decreases incidence of ischemic strokes	Pearl millet Foxtail millet		
	Rich in potassium	Leads to vasodilatation and decreases blood pressure and cardiovascular risk	Little millets Pearl millet		
	High in dietary fiber	Improves dyslipidemia by reducing LDL, decreasing triglycerides and increasing HDL	Sorghum (grain sorghum lipid extract—GSL) Porso millet Finger millet Barnyard millet		
	High in antioxidants	Prevents heart disease	Pearl millet		
Diabetes mellitus	Low-to-intermediate glycemic index	Decreases blood sugar and improves glycemic control	Sorghum (slow digestible starch—SDS) Barnyard millet Foxtail millet Porso millet		
	High in magnesium, vitamin E, phenolic compounds, and tannins	Lowers risk of diabetes mellitus as they slow the sudden increase in blood glucose and insulin levels	Sorghum Pearl millet		
	Insulin sensitivity	Improves action of insulin and decreases fasting blood sugars	Pearl millet Porso millet		
	High in dietary fiber	Slows absorption of carbohydrates, reduces digestibility, and prevents surge on blood sugars postprandially	Pearl millet Finger millet (alpha amylase inhibition) Barnyard millet		
	Rich in antioxidants and phenolic compounds	Inhibits aldose reductase and exerts antidiabetic property	Finger millet Barnyard millet		
	Cancer	Rich in phenolic acids, tannins, and phytate	Reduces the risk of colon and breast cancer Lower incidence of esophageal cancer	Sorghum (antimutagenic and anticarcinogenic properties—polyphenols and tannins) Kodo millet Finger millet Foxtail millet Proso millet Pearl millet Little millets	
High in dietary fiber		Lower incidence of esophageal and colonic cancer	Sorghum Pearl millet Finger millet Barnyard millet		
Quercetin, curcumin, ellagic acid, and various other beneficial catechins		Prevention of cancer by beneficial impact on neutralizing the free radicals	Kodo millet Finger millet Little millets Foxtail millet Barnyard millet Sorghum		
Constipation		High in dietary fiber	Eliminating disorders, such as constipation, excess gas, bloating, and cramping	Sorghum Pearl millet Finger millet Barnyard millet	
		Obesity	High in dietary fiber	Hunger satisfaction, increases satiety and thereby reducing the risk of development of obesity	Sorghum Pearl millet Finger millet Little millets
			Tryptophan	Lowers appetite and helps in keeping weight in control	Finger millet
Celiac disease	Gluten free	Gluten free	Sorghum Pearl millet		
Anemia	Good source of natural iron	Improves hemoglobin status	Finger millet (germinating variety) Little millets		

Contd...

Table 2: Contd...

Diseases	Elements that lead to benefits	Translated health benefits	Millets mainly helpful
Cataract	Gallic, protocatechuic, p-hydroxybenzoic, P coumaric, vanillin, syringic, ferulic, trans-cinnamic acids, quercetin	Inhibiting cataractogenesis Decreasing cataracts in human eye	Finger millet Barnyard millet
Bronchial asthma	Rich in magnesium	Decreases acute exacerbation of asthma	Pearl millet Little millets
Migraine	Rich in magnesium	Decreased frequency of migraine	Pearl millet
Gallstone	High in dietary fiber	Decreases incidence of gallstone formation	Pearl millet
Osteoporosis	Rich in calcium	Natural calcium that helps for bone strengthening and helps in reducing the risk of bone fractures	Finger millet Sorghum Little millets
Pellagra	Rich in niacin (vitamin B3)	Prevents deficiency of vitamin B3	Porso millet Little millets

- Ready-to-eat (RTE) and ready-to-serve (RTS) products: The government is also mobilizing start-ups for export promotion of value-added products in the RTE and RTS category, such as noodles, pasta, breakfast cereal mix, biscuits, cookies, snacks, and sweets.
- The government has also started formulating a five-year strategic plan for the promotion of millets and value-added millet products in the international market in association with the Indian Council of Agricultural Research (ICAR)–IIMR, Hyderabad, the Indian Council of Medical Research (ICMR)–National Institute of Nutrition, Hyderabad, the Council of Scientific and Industrial Research (CSIR)–Central Food Technological Research Institute (CFTRI), Mysore, and FPOs.
- The center has created the Nutri-Cereals Export Promotion Forum to give impetus to the export of potential products, including millets, and to remove the bottlenecks in the supply chain of Nutri-cereals.
- Indian missions abroad: The government of India (GOI) is leaving no stone unturned and has roped in Indian missions abroad for branding and publicity of Indian millets by facilitating participation through the international trade expos, direct tie-ups with international chefs and other potential buyers, organizing millet promotional activities abroad in collaboration with the Agricultural and Processed Food Products Export Development Authority (APEDA), and also increasing the sale of millets and their value-added products.

Further initiatives that can be taken by the government and various stakeholders:

1. Introducing millets in the school lunch programs
2. Providing subsidies and support for millet cultivation, processing, and marketing.
3. Encouraging research and development in the cultivation, processing, and utilization of millets.
4. Establishing training and capacity building for farmers, processors, and entrepreneurs involved in the millet value chain.
5. Raising awareness about millets and their health and nutritional benefits through campaign and media outreach.
6. Encouraging the private sector to invest in the millet value chain, including processing, packaging, and marketing.

Initiatives taken at All India Institute of Medical Sciences (AIIMS), Bibinagar

AIIMS, Bibinagar, Hyderabad, is one of the apex healthcare institutes of National Importance (INI), established by the Ministry of Health and Family Welfare (MoHFW), GOI, under the Pradhan Mantri Swasthya Suraksha Yojana (Phase VII), and made its beginning in 2019. IYOM 2023, one of the flagship initiatives of GOI, is being implemented at AIIMS, Bibinagar. We at our institute have taken the following initiatives and planned many more for this year.

1. Introducing millets as a part of meals for students, faculty, and healthcare workers at the institute mess and canteen.
2. Introducing millets as a part of meal for patients attending outpatient department or admitted at our hospital.
3. We are propagating information about the health benefits of millets in various diseases through banners, standees, and other Information, Education & Communication materials throughout our campus.
4. The institute promotes millets by distributing millet-based snacks or food products during institute events.
5. The students, faculty, and other staff of AIIMS, Bibinagar, undertook a “Walkathon” to create awareness about the health benefits of millets. This was followed by introducing the students, staff, and other workers about “RTE” options of millets easily available in the market.
6. The institute is in the process of framing a “task force” to enhance the promotion of millets and to advance the research in this area.
7. For the future, AIIMS, Bibinagar, has planned many more interesting initiatives
 - A cooking competition for innovative and healthy recipes based on millets is being planned to encourage students and staff of the institute to become ambassadors for millets.

- An awareness program for the mothers attending the rural health center of the institute is being planned to make them aware of the various health benefits of millets in improving the health of children.
- The institute is planning a Continuing medical education to campaign and advocate for the benefits of millets.
- The institute is planning to procure and place millet vending machine.

CONCLUSION

The promotion of millets is crucial for improving food security, promoting sustainable agriculture, and improving health outcomes. The government and relevant stakeholders need to work together to ensure that millets are widely available, and their consumption is promoted. This will help in increasing the importance of millets in the Indian food system, contributing to the health and well-being of people and the environment.

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Conflicts of interest

There are no conflicts of interest.

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