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Millets: The Ancient Grains Powering Modern Health

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Millets, a diverse group of small-seeded C4 cereal crops, represent one of the oldest domesticated food sources in human history. Traditionally cultivated across the semi-arid tropics of Asia and Africa, millets sustained populations in ecologically fragile regions due to their exceptional adaptability and low input requirements. Although their prominence declined during the Green Revolution with the expansion of high-yielding rice and wheat systems, millets are now undergoing a significant resurgence. This renewed interest is driven by their superior nutritional attributes, functional health benefits, and strategic importance in climate-resilient agriculture.

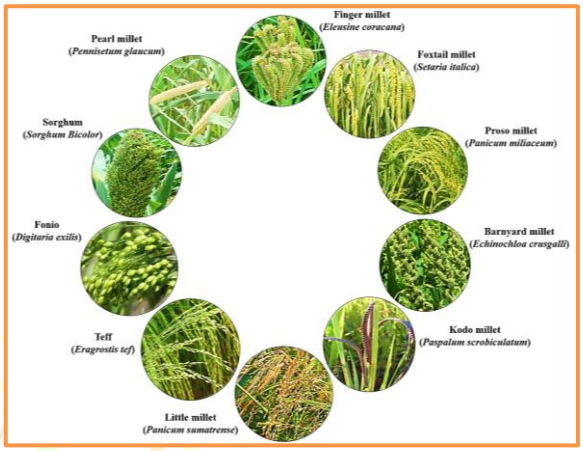

Fig 1. Classification of Millets

Nutritional Superiority and Functional Attributes

Millets including finger millet (*Eleusine coracana*), pearl millet (*Pennisetum glaucum*), foxtail millet (*Setaria italica*), and kodo millet (*Paspalum scrobiculatum*) exhibit remarkable nutritional diversity and density. Unlike refined cereals, millets retain their bran and germ layers, resulting in higher concentrations of dietary fiber, resistant starch, and bioactive compounds. They are rich sources of complex carbohydrates, moderate-quality proteins, and essential amino acids such as methionine and cysteine, which are often limiting in other cereals. In addition, millets provide substantial amounts of micronutrients, particularly iron, calcium, magnesium, phosphorus, and B-complex vitamins. Finger millet, for instance, is recognized for its exceptionally high calcium content, while pearl millet is valued for its superior iron bioavailability. A key functional characteristic of millets is their low glycemic index (GI), which contributes to a slower rate of starch digestion and glucose absorption. This property is mediated by their high fiber content, enzyme inhibitors, and polyphenolic compounds, making millets particularly effective in modulating postprandial glycemic responses. Consequently, they are highly recommended in dietary interventions targeting type-2 diabetes and metabolic syndrome. Furthermore, millets are naturally gluten-free and possess significant antioxidant potential due to the presence of phenolic acids, flavonoids, and tannins. These bioactive constituents confer protective effects against oxidative stress, inflammation, and chronic non-communicable diseases, including cardiovascular disorders and certain cancers. Emerging research also highlights their role in improving gut microbiota composition, thereby contributing to overall metabolic health.

Climate Resilience and Agro-Ecological Significance

From an agronomic perspective, millets are inherently resilient crops adapted to marginal environments characterized by erratic rainfall, high temperatures, and poor soil fertility. Their C4 photosynthetic pathway enhances water-use efficiency and biomass accumulation under stress conditions, making them particularly suited to semi-arid and arid agro-ecosystems. Millets require significantly less water often one-third to one-fifth of that required by rice and have shorter growth cycles, enabling flexible cropping systems and reduced exposure to climatic risks. Additionally, their minimal dependence on synthetic fertilizers and pesticides lowers production costs and reduces the environmental footprint of cultivation. The promotion of millets aligns closely with the principles of climate-smart agriculture, as they contribute to resource conservation, soil health improvement, and agro-biodiversity enhancement. For smallholder and rainfed farmers, millets offer a sustainable and economically viable alternative, ensuring livelihood security under increasingly unpredictable climatic conditions.

Fig 2. Nutritional significance of millets

Contemporary Relevance and Dietary Integration

In recent years, millets have undergone a significant transformation from being subsistence-oriented staples to emerging as high-value functional foods within both urban and global food systems. This transition has been driven by advancements in food science and processing technologies, which have enhanced their palatability, shelf life, and commercial viability. Modern processing techniques *viz.*, including extrusion, malting, fermentation, and micronization have enabled the development of diversified millet-based products such as ready-to-eat (RTE) and ready-to-cook (RTC) formulations, gluten-free bakery items, breakfast cereals, pasta analogues, and nutraceutical products enriched with bioactive compounds. The growing demand for millets is further reinforced by heightened consumer awareness of the adverse health effects associated with refined carbohydrates and ultra-processed foods. As dietary patterns shift toward low glycemic index, high-fiber, and nutrient-dense foods, millets are increasingly recognized for their functional properties, including glycemic regulation, antioxidant activity, and gut health modulation. Their inherent gluten-free nature also positions them as a key ingredient in specialized diets catering to individuals with celiac disease, gluten intolerance, and metabolic disorders. Culinary innovation has played a pivotal role in redefining the perception of millets, integrating them seamlessly into both traditional and contemporary gastronomic frameworks. While they continue to be utilized in conventional preparations such as idli, dosa, roti, and porridges, millets are now being incorporated into a wide spectrum of value-added products, including snack bars, health mixes, beverages, and fortified foods. The fusion of traditional knowledge with modern culinary techniques has enhanced their sensory appeal, making them more acceptable to urban consumers and younger demographics. From a market perspective, the millet value chain is witnessing rapid expansion, supported by policy initiatives, entrepreneurial ventures, and increasing investments in agri-food innovation. The positioning of millets as “smart foods” aligns with global trends emphasizing sustainability, nutritional security, and functional nutrition. Consequently, millets are not only redefining dietary

patterns but also contributing to the development of resilient and diversified food systems, bridging the gap between traditional agriculture and modern consumer demands.

Value Chain Development and Economic Opportunities

Beyond their nutritional and agronomic importance, millets are emerging as key drivers of rural economic growth and agri-food entrepreneurship. Expanding consumer demand has created new opportunities across the value chain, from production and processing to marketing and export. Value addition through primary processing (such as dehulling, grading, and milling) and secondary processing (development of ready-to-eat and ready-to-cook products) significantly enhances the economic value of millets compared to raw grains. The rise of millet-based startups, farmer producer organizations (FPOs), and small-scale enterprises has improved market access and price realization for farmers. Digital platforms and e-commerce channels are further accelerating the penetration of millet products into urban and global markets. In India, supportive policy frameworks including minimum support prices (MSP), inclusion in public distribution systems (PDS), and national promotional initiatives have strengthened both production and consumption ecosystems. Millets also present significant opportunities for women-led enterprises and self-help groups, particularly in processing and value addition, thereby promoting inclusive rural development and income diversification. Additionally, the growing global demand for gluten-free and health-oriented foods is enhancing the export potential of millets and their derived products. The development of efficient and integrated millet value chains is therefore essential to transform these crops into economically competitive commodities while simultaneously supporting sustainable agriculture and rural livelihoods.

Strategic Importance and Future Outlook

The growing global recognition of millets as “smart foods” reflects their multifaceted potential to address some of the most pressing challenges confronting contemporary food systems. Their dual capacity to enhance nutritional security while promoting environmental sustainability positions them at the nexus of agriculture, health, and climate policy. In this context, governments, research institutions, and international organizations are increasingly prioritizing millets through targeted policy frameworks, investment in research and development, and strengthening of value chains. Efforts are being directed toward improving genetic potential through advanced breeding approaches, enhancing yield stability under diverse agro-climatic conditions, and developing efficient post-harvest and processing technologies to increase consumer acceptability and market competitiveness. Furthermore, the integration of millets into national and global food policies such as their inclusion in public food distribution systems, school feeding programs, and nutrition-sensitive agriculture initiatives demonstrates their strategic importance in combating hidden hunger and micronutrient deficiencies. At the same time, innovations in agri-food systems, including biofortification, climate-resilient cropping systems, and digital agriculture, are expected to further enhance the production and utilization efficiency of millets. In the face of accelerating climate change, characterized by increased frequency of droughts, heat stress, and resource degradation, millets offer a resilient alternative to input-intensive cereal systems. Their low water requirement, adaptability to marginal soils, and reduced dependence on external inputs contribute to sustainable resource management and reduced environmental footprint. Simultaneously, the rising global burden of non-communicable diseases such as diabetes, cardiovascular disorders, and obesity has intensified the demand for functional foods with proven health benefits. Millets, with their low glycemic index, high dietary fiber, and rich antioxidant profile, align closely with evolving dietary preferences centered on preventive healthcare and nutritional well-being.

Fig 3. Representation of Millets in Sustainable and Resilient Food Systems

Conclusion

Millets represent a unique convergence of traditional agricultural knowledge and contemporary scientific validation, embodying both heritage and innovation within modern food systems. Their superior nutritional composition, encompassing essential micronutrients, bioactive compounds, and functional dietary components, underscores their role as nutritionally dense staples capable of addressing widespread deficiencies and promoting overall health. At the same time, their inherent resilience to abiotic stresses such as drought, heat, and poor soil fertility reinforces their significance in ensuring agricultural sustainability under changing climatic conditions. The reintegration of millets into mainstream diets and farming systems is therefore not simply a revival of traditional practices but a deliberate and forward-looking strategy aimed at enhancing food and nutritional security. It reflects a paradigm shift toward sustainable consumption patterns, diversification of cropping systems, and reduced ecological impact of agriculture. Moreover, the expanding scope of millet-based innovations in food processing, value addition, and market development further strengthens their relevance in contemporary agri-food economies. In essence, millets are not relics of the past but vital components of future-ready food systems. Their capacity to simultaneously address nutritional challenges, environmental constraints, and economic opportunities makes them indispensable in shaping a healthier, more resilient, and sustainable global future.

References

1. Kumar, A., Rani, M., Mani, S., Shah, P., Singh, D. B., Kudapa, H., & Varshney, R. K. (2021). Nutritional significance and antioxidant-mediated antiaging effects of finger millet: Molecular insights and prospects. *Frontiers in Sustainable Food Systems*, *5*, 684318.
2. Das, S., Khound, R., Santra, M., & Santra, D. K. (2019). Beyond bird feed: Proso millet for human health and environment. *Agriculture*, 9(3), 64.
3. Gupta, P., & Rikhari, A. (2024). Health benefits of millets: A comprehensive review. *Research & Reviews: Journal of Food Science and Technology*, 13(3), 26–35.
4. Muskan, F., Redhu, M., Redhu, S., & Rahimi, M. (2025). Millets in the global market: a critical review of challenges and opportunities. *Food Production, Processing and Nutrition*, *7*(1), 37.
5. Kumar, S., & Jhamta, R. (2026). Evaluation of the Potential of Millets in Emerging Markets: Opportunities and Sustainability. In *Millets as Superfood* (pp. 217-229). CRC Press.
6. Zahra, N., Saeed, M. K., Saeed, A., Javed, N., & Rabiya, A. (2025). Milletes for Global Food Security. *J. Nutrition and Food Processing*, *8*(2).