



## Nutritional & Nutraceutical Potential of Millets - A Mighty Cereal

S. Vijaya<sup>1</sup>, Garima Bartariya<sup>1</sup>, Shivali Rathore<sup>1</sup>, A. Suvarna Latha<sup>2</sup>, Namdeo Bhagwan Admuth<sup>3</sup>, Pratima Sahu<sup>4</sup>, Bhagyashree Barbhui<sup>5</sup>, Ruchita Shrivastava<sup>6(a)\*</sup>, Mukul Machhindra Barwant<sup>6(b)\*</sup>

<sup>1</sup>Assistant Professor, Department of Botany Tara Government College (A), Sangareddy, Telangana State-502001

<sup>1</sup>Associate Professor, Department of Botany School of Life Science & Technology, IIMT University, Meerut Dist. Meerut (UP) Pin Code - 250001

<sup>1</sup>Assistant Professor, Government College Patharia District Damoh, MP

<sup>2</sup>Assistant Professor in Botany, Dept. of Biosciences and Sericulture Sri Padmavati Mahila Viswavidyalayam, Tirupati

<sup>3</sup>Assistant Professor, Department of Botany, Annasaheb Awate Arts, Commerce and Hutatma Babu Genu Science College, Manchar, Dist. Pune Maharashtra

<sup>4</sup>Assistant professor, Shri Rawatpura Sarkar University, Raipur, Chhattisgarh, India.

<sup>5</sup>Assistant Professor, Sri Balaji University, Pune, Maharashtra.

<sup>6a\*</sup> Ex -Faculty (Horticulture, Adhoc), Govt. Homescience PG Lead College, Narmadapuram (MP).

<sup>6b\*</sup> Assistant Professor, Sanjivani Arts Commerce and Science College Kopargaon Maharashtra India

\*Corresponding author's: Ruchita Shrivastava, Mukul Machhindra Barwant

Article History	Abstract
Received: 06 June 2023 Revised: 05 Sept 2023 Accepted: 14 Nov 2023	<p><b>Millets: Tiny Grains, Mighty Nutrition,</b> Millets, the ancient grains often overshadowed by their larger cereal counterparts, are experiencing a resurgence in the world of nutrition and health. This chapter explores the captivating nutritional and nutraceutical potential of millets, unearthing their secrets and showcasing their significance in modern diets. Millets are nutrition powerhouses, offering a balanced blend of macronutrients, abundant dietary fiber, and a wealth of vitamins and minerals. Their exceptional health benefits encompass weight management, glycemic control, and heart health. Moreover, the antioxidant-rich millets contribute to disease prevention and well-being. Remarkably, millets serve as gluten-free champions, providing safe alternatives for individuals with celiac disease and gluten sensitivities. They extend their prowess beyond nutrition, demonstrating anti-inflammatory and anticancer properties, opening doors to potential nutraceutical applications. This chapter delves into culinary creativity, offering enticing millet-based recipes to make their inclusion in everyday meals a delightful reality. Additionally, it sheds light on the agricultural sustainability of millets, emphasizing their role in preserving biodiversity and their adaptability to a changing climate. While celebrating the wonders of millets, challenges and opportunities in research, promotion, and policy advocacy are also addressed. Millets, these mighty yet modest grains, beckon us to embrace their nutritional treasures, promoting health and sustainability for a brighter future.</p>
CC License CC-BY-NC-SA 4.0	<b>Keywords:</b> Millets, Nutrition, Nutraceutical, Gluten-Free, Sustainability, Health Benefits, Culinary Creativity.

## 1. Introduction

### Millets: Ancient Grains with Modern Appeal

Millets, often hailed as "ancient grains," have been an integral part of human diets for thousands of years (Cheng et al., 2018). Their historical significance transcends generations and cultures, making them grains with a timeless appeal. In this chapter, we embark on a journey through time and geography to explore the rich historical significance and the captivating diversity of millet species that have sustained communities for millennia.

## ***Historical Significance***

The historical tapestry of millets spans across continents and epochs, showcasing their resilience and adaptability. From the cradle of agriculture in Asia and Africa to the New World, millets have been cherished for their reliable yields and nutritional value. We delve into the annals of history to uncover how millets have shaped civilizations and diets, leaving an indelible mark on human culture ( Scott et al.,2017).

## ***Diversity of Millet Species***

The world of millets is diverse, boasting a multitude of species, each with its unique characteristics and culinary potential (Shahzad et al., 2021; Dang et al.,2020). From pearl millet to finger millet and foxtail millet to proso millet, we explore the range of millet varieties cultivated globally. Understanding this diversity is crucial not only for preserving genetic resources but also for harnessing their nutritional and agricultural potential in the modern era.

## **Nutritional Composition of Millets: Nature's Nutrient Powerhouses**

Millets are more than just historical relics; they are nutritional powerhouses that provide a wealth of essential nutrients (Navarro et al., 2021; Makam et al.,2021). In this section, we dissect the nutritional composition of millets, uncovering the balance of macronutrients, the abundance of vitamins and minerals, and the significant dietary fiber content that makes them a standout choice in modern diets.

### *Macronutrients in Millets* (De et al.,2016):

Millets offer a well-rounded nutritional profile, with carbohydrates, proteins, and fats in proportions that align with dietary recommendations. We delve into the macronutrient content of millets, highlighting their potential to provide sustained energy, support muscle growth, and maintain overall health.

### *Micronutrients and Vitamins* (Anitha et al., 2020):

Beyond macronutrients, millets are rich in essential micronutrients and vitamins, playing a crucial role in preventing nutritional deficiencies. We explore the vitamin and mineral content of millets, emphasizing their contribution to immune function, bone health, and overall well-being.

### *Dietary Fiber Content* (Rawat et al.,2023):

One of the standout features of millets is their exceptional dietary fiber content. This chapter discusses the types of dietary fiber found in millets and their myriad benefits, including digestive health, weight management, and blood sugar control. Understanding the fiber content of millets underscores their modern appeal as health-conscious consumers seek fiber-rich foods.

In the following sections of this chapter, we will delve deeper into the health benefits, culinary versatility, and agricultural sustainability of millets, shedding light on why these ancient grains continue to captivate the modern world.

## **Health Benefits of Millets: A Comprehensive Overview**

In this chapter, we uncover the diverse array of health benefits that millets offer, showcasing their potential to contribute to overall well-being and a balanced diet (Sharma et al.,2018 ; Dayakar et al.,2017) .

- **Weight Management and Satiety**
  - The role of millets in weight management
  - Satiety-promoting properties of millets
  - Incorporating millets into weight-conscious diets
- **Glycemic Control and Diabetes Management**
  - Managing blood sugar levels with millets
  - The glycemic index of millets
  - Millets as a staple for diabetes-friendly diets
- **Heart Health and Cholesterol Reduction**
  - Millets as allies for heart health

- Reducing cholesterol levels with millet consumption
- Cardioprotective benefits of millets
- **Digestive Health and Gut Microbiota**
  - Promoting digestive health with millets
  - Millets as a source of dietary fiber
  - Nurturing a healthy gut microbiota through millet consumption
- **Antioxidants and Phytochemicals in Millets: Guardians of Health**
  - The significance of antioxidants in disease prevention
  - Identifying specific phytochemicals in millets
  - Harnessing the antioxidant potential of millets

### Functional Properties of Millets: Beyond Nutrition (Amadou et al.,2020):

#### Anti-Inflammatory Properties

- Inflammation and its role in chronic diseases
- Millets as anti-inflammatory agents
- Mechanisms of action and potential health implications

#### Anticancer Potential

- The link between diet and cancer prevention
- Exploring millets' role in cancer prevention
- Emerging research on millets' anti-cancer properties

#### Immune System Modulation

- The pivotal role of the immune system in health
- Millets and immune system support
- Immune-modulating compounds in millets



**Figure 1:** Health benefits of millets

### **Culinary Uses of Millets: Incorporating Nutrition into Everyday Meals (Hassan et al.,2021) :**

Millets are not only nutritious but also versatile in the culinary world. This section explores how to turn these ancient grains into delicious and nourishing dishes that can be seamlessly integrated into daily diets.

- **Millet-Based Recipes from Around the World**
  - Exploring global cuisines that feature millets
  - Traditional and contemporary millet-based recipes
  - Tasty and culturally diverse ways to enjoy millets
- **Cooking Techniques and Meal Ideas**
  - Cooking methods for millets: boiling, roasting, and more
  - Creative meal ideas with millets for breakfast, lunch, and dinner
  - Millets in snacks, desserts, and beverages
- **Millet Products in the Market**
  - Overview of millet-based products available in stores
  - Commercial millet-based foods and beverages
  - Navigating the market for millet-related products

### **Agricultural and Environmental Sustainability of Millets (Yang et al.,2022) :**

- The cultivation and conservation of millets play a vital role in promoting both agricultural sustainability and environmental preservation.
- **Millet Cultivation Practices**
  - Sustainable farming techniques for millets
  - Organic and eco-friendly millet cultivation
  - The importance of crop rotation and mixed farming
- **Biodiversity and Conservation Efforts**
  - Preserving the genetic diversity of millet species
  - Conservation initiatives for rare and indigenous millets
  - The role of seed banks and research in biodiversity conservation
- **Climate-Resilient Crops**
  - Millets as climate-smart crops
  - Drought and heat tolerance of millets
  - Millets in sustainable agriculture and climate change adaptation

## **4. Conclusion**

### **Embracing Millets for a Healthier and Sustainable Future**

In this comprehensive exploration of millets, we have uncovered the remarkable attributes that make these ancient grains a modern nutritional powerhouse. From their historical significance to their diverse health benefits and nutraceutical potential, millets have proven to be grains worthy of our attention and incorporation into daily diets.

Millets have demonstrated their prowess in weight management, glycemic control, heart health, and digestive well-being. They serve as guardians of health through their rich antioxidant content and specific phytochemicals. Furthermore, millets offer a gluten-free haven for individuals with celiac disease and gluten sensitivity, ensuring a safe and nutritious dietary alternative.

In the realm of culinary arts, millets shine through their versatility, allowing us to create a myriad of delectable dishes from various corners of the world. Cooking techniques and meal ideas have shown that millets can be seamlessly integrated into breakfast, lunch, dinner, snacks, desserts, and even

beverages. The market offers a growing array of millet-based products, making it easier than ever to embrace these grains.

Beyond our plates, millets contribute to agricultural and environmental sustainability. Sustainable farming practices, conservation efforts, and their role as climate-resilient crops underscore their importance in building a resilient and eco-friendly food system.

As we conclude this journey through the world of millets, we find ourselves at a crossroads of opportunity and responsibility. Millets have the potential to not only improve individual health but also to contribute to a sustainable and resilient global food supply. It is incumbent upon us, as consumers, advocates, and policymakers, to embrace millets for the myriad benefits they offer and to champion their role in shaping a healthier and more sustainable future for all. The time to make millets a staple in our diets and agricultural practices is now, and the rewards for our health and the planet's well-being are boundless.

### References:

1. Amadou, I. (2022). Millet Based Functional Foods: Bio-Chemical and Bio-Functional Properties. *Functional Foods*, 303-329.
2. Anitha, S., Govindaraj, M., & Kane-Potaka, J. (2020). Balanced amino acid and higher micronutrients in millets complements legumes for improved human dietary nutrition. *Cereal Chemistry*, 97(1), 74-84.
3. Cheng, A. (2018). Shaping a sustainable food future by rediscovering long-forgotten ancient grains. *Plant Science*, 269, 136-142.
4. Dang, K., Gong, X., Zhao, G., Wang, H., Ivanistau, A., & Feng, B. (2020). Intercropping alters the soil microbial diversity and community to facilitate nitrogen assimilation: a potential mechanism for increasing proso millet grain yield. *Frontiers in Microbiology*, 11, 601054.
5. Dayakar Rao, B., Bhaskarachary, K., Arlene Christina, G. D., Sudha Devi, G., Vilas, A. T., & Tonapi, A. (2017). Nutritional and health benefits of millets. *ICAR\_Indian Institute of Millets Research (IIMR) Rajendranagar, Hyderabad*, 2.
6. De Luca, A., Frassetto-Darrieux, M., Gaud, M. A., Christin, P., Boquien, C. Y., Millet, C., ... & Hankard, R. (2016). Higher leptin but not human milk macronutrient concentration distinguishes normal-weight from obese mothers at 1-month postpartum. *PLoS One*, 11(12), e0168568.
7. Hassan, Z. M., Sebola, N. A., & Mabelebele, M. (2021). The nutritional use of millet grain for food and feed: a review. *Agriculture & food security*, 10, 1-14.
8. Makam, S. (2021). Immunity–The only way now, to Fight Corona. *SAR J Med Biochem*, 2(2), 32-39.
9. Navarro, M. C. (2021). Radical recipe: Veganism as anti-racism. In *The Routledge Handbook of Vegan Studies* (pp. 282-294). Routledge.
10. Rawat, D. K., Prajapati, S. K., Kumar, P., Prajapati, B. K., Kumar, V., & Dayal, P. (2023). Policy and Research Recommendations for Millets: Addressing Challenges and Production Opportunities to Ensure Food and Nutritional Security.
11. Scott, J. C. (2017). *Against the grain: A deep history of the earliest states*. Yale University Press.
12. Shahzad, A., Ullah, S., Dar, A. A., Sardar, M. F., Mehmood, T., Tufail, M. A., ... & Haris, M. (2021). Nexus on climate change: Agriculture and possible solution to cope future climate change stresses. *Environmental Science and Pollution Research*, 28, 14211-14232.
13. Sharma, N., & Niranjana, K. (2018). Foxtail millet: Properties, processing, health benefits, and uses. *Food reviews international*, 34(4), 329-363.
14. Yang, J., Zhang, D., Yang, X., Wang, W., Perry, L., Fuller, D. Q., ... & Chen, F. (2022). Sustainable intensification of millet–pig agriculture in Neolithic North China. *Nature Sustainability*, 5(9), 780-786.