E-ISSN: 2618-0618
P-ISSN: 2618-060X

www.agronomyjournals.com
2024; 7(5): 546-550
Received: 16-02-2024
Accepted: 26-04-2024

Gangadhara Doggalli
Ph.D. Scholar, Department of Genetics and Plant Breeding, University of Agricultural Sciences, Dharwad, Karnataka, India

Okram Ricky Devi
Ph.D. Scholar, Department of Agronomy, AAU- Jorhat, Assam, India

Sanjay Hazarika
Ph.D. Scholar, Department of Entomology, AAU, Jorhat, Assam, India

Dr. Awanindra Kumar Tiwari
Scientist- Plant Protection-Entomology, Krishi Vigyan Kendra, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, Uttar Pradesh, India

Dechen Angmo
Ph.D. Scholar, Dr. YS Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh, India

Bibek Laishram
Ph.D. Scholar, Agronomy Department, AAU- Jorhat, Assam, India

Dr. Sanjenbam Sher Singh
Ph.D, Agricultural Extension, College of Post Graduate Studies in Agricultural Sciences, Central Agricultural University, Imphal, Umiam, Meghalaya, India

Oinam Bobochand Singh
Department of Plant Breeding and Genetics, Assam Agricultural University, Assam, India

Corresponding Author:
Gangadhara Doggalli
Ph.D. Scholar, Department of Genetics and Plant Breeding, University of Agricultural Sciences, Dharwad, Karnataka, India

Minor millets: An underutilized grains to ensure food security

Gangadhara Doggalli, Okram Ricky Devi, Sanjay Hazarika, Dr. Awanindra Kumar Tiwari, Dechen Angmo, Bibek Laishram, Dr. Sanjenbam Sher Singh and Oinam Bobochand Singh

DOI: https://doi.org/10.33545/2618060X.2024.v7.i5g.735

Abstract
Minor millets, often overshadowed by their major cereal counterparts, possess untapped potential in securing food sustainability and enhancing global nutrition. This paper explores the multifaceted advantages of minor millets, including their nutritional richness, agronomic resilience, and socio-economic significance. Through an extensive review of literature and case studies, it elucidates the pivotal role of these underutilized grains in addressing key challenges such as malnutrition, climate change, and rural poverty. By promoting the cultivation and consumption of minor millets, policymakers, researchers, and communities can unlock pathways toward resilient, inclusive, and sustainable food systems. This abstract serves as a call to action for stakeholders to recognize and harness the inherent value of minor millets in shaping a more equitable and nourished world. This article explores the critical role of minor millets in ensuring food security and sustainability. Despite their nutritional richness and resilience to environmental stress, minor millets have been largely underutilized. Through a comprehensive review of existing literature and case studies, this paper highlights the significance of incorporating minor millets into agricultural and dietary practices. It discusses the nutritional benefits, agronomic advantages, and socio-economic implications of promoting minor millet cultivation. Moreover, it addresses the challenges and opportunities associated with mainstreaming these grains into food systems. By shedding light on the untapped potential of minor millets, this article advocates for policy interventions and community-based initiatives to enhance food security and promote sustainable agriculture.

Keywords: Minor millets, food security, sustainability, underutilized grains, agriculture, nutrition

Introduction
In the face of global challenges such as climate change, population growth, and diminishing natural resources, ensuring food security has become increasingly paramount. Traditional grains, particularly minor millets, hold immense potential in addressing these challenges due to their nutritional richness, climate resilience, and low resource requirements. However, despite their inherent advantages, minor millets have remained marginalized in agricultural systems and dietary patterns [1-2]. This article seeks to elucidate the underexplored potential of minor millets in securing food sustainability and proposes strategies for their integration into mainstream food systems. In an era marked by escalating concerns over food security, the imperative to diversify agricultural systems and enhance resilience against environmental uncertainties has never been more pressing. Amidst this backdrop, the spotlight is increasingly turning towards minor millets, often overshadowed by their major cereal counterparts but harboring immense potential in contributing to global food security and sustainability. Minor millets, encompassing a diverse array of grains such as finger millet (ragi), foxtail millet, pearl millet, and others, represent a rich repository of nutrition, adaptability, and cultural heritage that remains largely untapped on a global scale [3-5]. Minor millets lies their unparalleled nutritional richness. These grains, often termed as 'nutri-cereals,' boast an impressive nutritional profile, brimming with protein, dietary fiber, vitamins, and minerals. Moreover, they stand out for their gluten-free nature, making them suitable for individuals with celiac disease or gluten sensitivities. The incorporation of minor millets into dietary patterns holds significant promise in combating malnutrition, addressing

dietary deficiencies, and promoting overall health and well-being, particularly in regions where access to diverse and nutritious foods is limited [6].

Nutritional virtues, minor millets exhibit remarkable agronomic resilience, thriving in diverse agro-climatic conditions and requiring minimal inputs such as water and fertilizers. This inherent adaptability positions them as indispensable allies in the quest for climate-resilient agriculture [7]. In an era marked by escalating climate variability and extreme weather events, the cultivation of minor millets offers a pathway towards building resilient agricultural systems capable of withstanding environmental shocks and fluctuations. Moreover, their innate resistance to pests and diseases reduces the dependence on chemical inputs, thereby promoting ecologically sustainable farming practices. However, despite their myriad benefits, minor millets have long languished on the side lines of agricultural policy and research agendas, relegated to the status of 'orphan crops.' The prevailing dominance of major cereals, coupled with entrenched market dynamics and consumer preferences, has hindered the mainstream adoption of minor millets. Overcoming these barriers necessitates a concerted effort encompassing policy reforms, research and development initiatives, market interventions, and consumer education campaigns [8-9]. By unlocking the full potential of minor millets, we can chart a course toward a more resilient, equitable, and sustainable food future for generations to come.

Nutritional Benefits of Minor Millets

Minor millets, including finger millet (ragi), foxtail millet, pearl millet, and others, are nutritional powerhouses rich in protein, dietary fiber, vitamins, and minerals. Compared to major cereals like rice and wheat, minor millets offer superior nutritional profiles, making them valuable components of a balanced diet. Incorporating minor millets into daily consumption can mitigate malnutrition and address dietary deficiencies, particularly among vulnerable populations in low-income countries. The nutritional benefits of minor millets serve as a cornerstone in their advocacy for enhancing food security and public health. These underutilized grains, including finger millet, foxtail millet, pearl millet, and others, boast an impressive array of nutrients that make them invaluable additions to the human diet [10-12]. First and foremost, minor millets are renowned for their high protein content, often surpassing that of major cereals like rice and wheat. Protein is essential for building and repairing tissues, supporting immune function, and maintaining overall health. Incorporating minor millets into the diet can help address protein deficiencies, particularly in populations where access to animal protein sources is limited [13].

Minor millets are rich sources of dietary fiber, both soluble and insoluble. Fiber plays a crucial role in digestive health, promoting regularity, preventing constipation, and reducing the risk of gastrointestinal disorders such as diverticulosis. Moreover, dietary fiber contributes to satiety, aiding in weight management and reducing the risk of obesity and related chronic diseases [14]. Minor millets are also notable for their micronutrient content, including vitamins and minerals essential for various physiological functions. These grains are particularly rich in iron, calcium, magnesium, phosphorus, and B-vitamins such as thiamine, riboflavin, and niacin. Iron is critical for oxygen transport in the blood and the prevention of anemia, while calcium supports bone health and muscle function. Magnesium and phosphorus are involved in energy metabolism and bone formation, while B-vitamins play vital roles in energy production, nerve function, and metabolism, minor millets are gluten-free, making them suitable options for individuals with celiac disease or gluten sensitivities. This gluten-free nature broadens their accessibility and appeal, allowing for inclusion in a wider range of dietary patterns and culinary traditions. Overall, the nutritional richness of minor millets positions them as potent allies in the fight against malnutrition, dietary deficiencies, and related health issues [15-16]. By promoting the cultivation and consumption of these grains, policymakers, researchers, and communities can make significant strides towards enhancing public health and well-being while fostering sustainable food systems for future generations.

Nutrient	Finger Millet	Foxtail Millet	Pearl Millet	Other Minor Millets
Protein (g/100g)	7.3	11.2	10.6	Varies
Dietary Fiber (g/100g)	3.6	8.6	1.3	Varies
Calcium (mg/100g)	344	31	42	Varies
Iron (mg/100g)	3.9	2.8	4.2	Varies
Magnesium (mg/100g)	287	252	110	Varies
Phosphorus (mg/100g)	283	220	242	Varies
Vitamin B1 (Thiamine) (mg/100g)	0.33	0.42	0.38	Varies
Vitamin B2 (Riboflavin) (mg/100g)	0.11	0.16	0.19	Varies
Vitamin B3 (Niacin) (mg/100g)	1.2	2.8	2.1	Varies

Note: Values may vary depending on specific varieties and processing methods.

Agronomic Advantages and Climate Resilience

One of the distinguishing features of minor millets is their adaptability to diverse agro-climatic conditions. These hardy crops require minimal inputs such as water and fertilizer, making them well-suited for cultivation in resource-constrained environments. Furthermore, minor millets exhibit resilience to pests, diseases, and adverse weather conditions, offering a buffer against climate-related risks [17-19]. By diversifying cropping systems with minor millets, farmers can enhance resilience and sustainability in agriculture while reducing reliance on external inputs. The agronomic advantages and climate resilience exhibited by minor millets underscore their potential as key components of sustainable agricultural systems, particularly in the face of climate change and environmental stressors.

One of the primary agronomic advantages of minor millets is their remarkable adaptability to diverse agro-climatic conditions. These grains thrive in a wide range of environments, from arid and semi-arid regions to areas with high rainfall and fluctuating temperatures [20-22]. Their ability to grow in such varied conditions makes them well-suited for cultivation in regions where other crops may struggle due to water scarcity, soil degradation, or extreme weather events, minor millets are characterized by their low input requirements, both in terms of water and fertilizers. Unlike many major cereal crops that are highly dependent on irrigation and chemical inputs, minor millets have relatively low water requirements and can often thrive with minimal or no irrigation [23-25]. This makes them particularly suitable for rainfed agriculture, reducing the pressure on water resources and mitigating the risks associated with water scarcity. In addition to their low input requirements, minor millets exhibit inherent resistance to pests, diseases, and adverse environmental conditions. These grains have evolved mechanisms to withstand biotic and abiotic stresses, making them more resilient to fluctuations in weather patterns, pest outbreaks, and soil degradation. Their resilience to pests and diseases reduces the need for chemical pesticides, promoting environmentally sustainable farming practices and minimizing the risks associated with pesticide exposure for farmers and consumers.

The deep root systems of many minor millet varieties contribute to soil health and fertility by enhancing soil structure, nutrient cycling, and water infiltration. This not only improves the productivity and sustainability of the land but also helps mitigate soil erosion and nutrient runoff, thereby safeguarding ecosystem integrity and reducing environmental degradation. Overall, the agronomic advantages and climate resilience of minor millets make them valuable assets in building resilient agricultural systems capable of adapting to the challenges posed by climate change and environmental degradation [26-29]. By promoting the cultivation of minor millets, policymakers, researchers, and farmers can enhance agricultural sustainability, improve food security, and foster resilience in the face of uncertain climatic conditions.

Agronomic Advantages	Climate Resilience Benefits
Enhanced plant growth	Improved nutrient uptake
Increased tiller formation	Reduced fertilizer runoff
Higher leaf area index	Enhanced soil health
Greater dry matter accumulation	Water conservation
Improved crop yield	Decreased greenhouse gas emissions

This table highlights some of the key agronomic advantages of using nano-fertilizers, such as enhanced plant growth, increased tiller formation, higher leaf area index, and greater dry matter accumulation. Additionally, it outlines the climate resilience benefits, including improved nutrient uptake, reduced fertilizer runoff, enhanced soil health, water conservation, decreased greenhouse gas emissions, and ultimately, improved crop yield.

Socio-economic Implications

The promotion of minor millets cultivation can have far-reaching socio-economic benefits, particularly for smallholder farmers and rural communities. By diversifying income sources and enhancing food security, minor millets contribute to poverty alleviation and rural development. Moreover, the revival of traditional millet-based livelihoods preserves indigenous knowledge systems and cultural heritage, fostering community resilience and identity [30-31]. The socio-economic implications of promoting minor millets cultivation extend far beyond the realm of agriculture, encompassing aspects of livelihoods, food security, cultural heritage, and community resilience.

The socio-economic significance of minor millets lies their potential to bolster rural livelihoods and alleviate poverty, particularly in marginalized and resource-constrained regions. Smallholder farmers, often the custodians of traditional millet cultivation practices, stand to benefit from the adoption and promotion of minor millets. By diversifying their cropping systems to include these resilient grains, farmers can enhance their income streams, reduce production risks, and improve household food security [32].

The cultivation of minor millets offers opportunities for value addition and market diversification, empowering farmers to capture higher returns from their produce, the revival of traditional millet-based livelihoods holds profound implications for preserving cultural heritage and indigenous knowledge systems. Many communities have deep-rooted cultural connections to minor millets, which play integral roles in rituals, ceremonies, and culinary traditions. By promoting the cultivation and consumption of minor millets, efforts can be made to safeguard and celebrate these cultural identities, fostering a sense of pride, belonging, and continuity among communities [33]. The rural livelihoods and cultural heritage, minor millets contribute to broader food security objectives by enhancing dietary diversity and nutritional resilience. The nutritional richness of minor millets, coupled with their gluten-free nature, makes them valuable additions to diets, particularly in regions where malnutrition and dietary deficiencies are prevalent. By incorporating minor millets into food programs and public distribution systems, policymakers can improve access to nutritious foods and combat hunger and malnutrition among vulnerable populations.

The promotion of minor millets cultivation can have ripple effects on gender dynamics and social equity within communities. In many contexts, women play central roles in the production, processing, and marketing of minor millets, serving as custodians of traditional knowledge and practices. By recognizing and supporting women's contributions to millet-based agriculture, efforts can be made to promote gender equality, empower women economically, and enhance their decision-making agency within households and communities, the socio-economic implications of promoting minor millets cultivation are multifaceted, spanning livelihoods, cultural heritage, food security, and gender equity. By harnessing the potential of these resilient grains, stakeholders can work towards building more inclusive, equitable, and resilient food systems that prioritize the well-being of both people and the planet [34].

Challenges and Opportunities

Despite their inherent advantages, several barriers hinder the widespread adoption of minor millets. These include limited market access, lack of awareness among consumers, and policy biases favoring major cereals. Addressing these challenges requires multi-stakeholder collaboration, including government interventions, research and development initiatives, and consumer education programs. By leveraging emerging trends such as the growing demand for healthy and sustainable foods, there are significant opportunities to promote minor millets as viable alternatives for food security and nutrition [35].

Navigating the landscape of promoting minor millets cultivation presents a complex interplay of challenges and opportunities, requiring multifaceted approaches and collaborative efforts from various stakeholders. One of the primary challenges in mainstreaming minor millets is the prevailing market dynamics and consumer preferences favouring major cereal crops. Despite their nutritional richness and agronomic advantages, minor millets often face limited market access and inadequate value chains, resulting in low demand and profitability for farmers. Addressing this challenge necessitates interventions aimed at market development, value addition, and consumer awareness. By promoting the nutritional benefits and culinary versatility of minor millets, efforts can be made to create demand and stimulate market growth, thereby incentivizing farmers to invest in their cultivation [36]. The lack of supportive policies and institutional frameworks poses a significant barrier to the widespread adoption of minor millets. Many agricultural policies and programs are biased towards promoting major cereal crops, overlooking the unique needs and challenges of minor millet farmers. Policy reforms are needed to incentivize and support the cultivation of minor millets through measures such as price incentives, subsidized inputs, and research and extension services tailored to their specific requirements. Additionally, institutional mechanisms can be strengthened to facilitate market linkages, value chain development, and farmer capacity building in minor millets production and marketing.

Technological constraints, including limited access to improved seed varieties, mechanization, and post-harvest processing technologies, hinder the productivity and profitability of minor millets cultivation. Research and development efforts are needed to develop and disseminate climate-resilient varieties, sustainable farming practices, and appropriate processing technologies tailored to the needs of minor millet farmers [37]. Additionally, investments in infrastructure, such as irrigation facilities, storage facilities, and transportation networks, can help overcome logistical challenges and enhance the efficiency of minor millet value chains. Despite these challenges, promoting minor millets cultivation presents significant opportunities for enhancing food security, nutrition, and sustainable agriculture. The growing demand for healthy and sustainable foods, coupled with increasing consumer awareness of the environmental and social impacts of food production, creates a favourable market environment for minor millets. By capitalizing on these trends and harnessing innovative approaches such as value-added products, eco-labeling, and e-commerce platforms, opportunities can be leveraged to expand market access and promote the mainstream adoption of minor millets, the resurgence of interest in traditional and indigenous foods, coupled with the recognition of the nutritional and cultural significance of minor millets, provides a platform for advocacy and collaboration among diverse stakeholders. By forging partnerships between governments, research institutions, civil society organizations, and private sector actors, concerted efforts can be made to overcome barriers, seize opportunities, and unlock the full potential of minor millets in contributing to food security, nutrition, and sustainable development, while promoting minor millets cultivation is not without its challenges, the inherent opportunities for enhancing food security, nutrition, and sustainable agriculture far outweigh the obstacles [37-41]. By addressing key challenges through targeted interventions and leveraging emerging opportunities, stakeholders can work together to create an enabling environment for the widespread adoption of minor millets, thereby realizing their potential as resilient and nutritious crops for the benefit of present and future generations.

Conclusion

Minor millets represent a promising yet underutilized resource in the quest for food security and sustainability. By recognizing their nutritional benefits, agronomic advantages, and socio-economic implications, stakeholders can advocate for policy reforms and investment strategies to mainstream minor millets into agricultural and dietary systems. Empowering smallholder farmers to cultivate minor millets and promoting consumer awareness and acceptance are essential steps towards harnessing the full potential of these resilient grains. In doing so, we can build more resilient food systems that nourish both people and the planet. In conclusion, the promotion of minor millets cultivation represents a pivotal pathway towards enhancing food security, nutrition, and sustainable agriculture in a rapidly changing world. Through their nutritional richness, agronomic resilience, and socio-economic significance, minor millets offer unique opportunities to address the complex challenges facing global food systems.

By recognizing and harnessing the nutritional benefits of minor millets, stakeholders can combat malnutrition, dietary deficiencies, and related health issues, particularly among vulnerable populations. Their adaptability to diverse agro-climatic conditions and low input requirements position them as indispensable allies in building climate-resilient agricultural systems capable of withstanding environmental stressors, the socio-economic implications of promoting minor millets cultivation extend beyond agricultural productivity to encompass livelihoods, cultural heritage, and community resilience. By empowering smallholder farmers, preserving indigenous knowledge systems, and fostering inclusive market opportunities, efforts can be made to enhance rural livelihoods, promote gender equity, and strengthen social cohesion, realizing the full potential of minor millets requires concerted action to address key challenges such as market access, policy biases, and technological constraints. By leveraging emerging opportunities such as growing consumer demand for healthy and sustainable foods, partnerships between governments, research institutions, civil society organizations, and private sector actors can drive transformative change in food systems, it is imperative for stakeholders to prioritize investments, policies, and initiatives that support the cultivation, consumption, and value addition of minor millets. By doing so, we can build more resilient, equitable, and sustainable food systems that nourish both people and the planet, ensuring a brighter future for generations to come.

References

1. Bhullar GS, Bhullar NK. Finger millet as a rich source of calcium: A review on processing, properties, and utilization. J Food Sci Technol. 2019;56(1):1-10.
2. DeFries RS, Herold M. Land use change and emissions

from food production: A brief overview. Environ Res Lett. 2020;15(7):071001.
3. FAO. The State of Food Security and Nutrition in the World 2019. Rome: Food and Agriculture Organization of the United Nations; c2019.
4. Sachan K, Saxena A, Kumar S, Mishra A, Verma A, Tiwari DD, *et al*. Urban Soil Health Check and Strategies for Monitoring and Improvement. J Divers Stud. 2024. https://doi.org/10.51470/JOD.2024.03.01.20
5. Goron TL, Raizada MN. Genetic diversity and genomic resources available for the small millet crops to accelerate a New Green Revolution. Front Plant Sci. 2015;6:157.
6. Krishna D, Vishnuvardhana R. Role of minor millets in food and nutritional security: A review. Int J Curr Microbiol Appl Sci. 2018;7(10):3860-3865.
7. Sapna, Vijay Kumar, Kushal Sachan, Abhishek Singh. IoT Innovations Revolutionizing Agricultural Practices for Sustainability. J Divers Stud. 2024. https://doi.org/10.51470/JOD.2024.03.01.29
8. Kumar D, *et al*. Minor millets: A potential source of nutrition for combating malnutrition in India. Int J Chem Stud. 2020;8(4):3224-3230.
9. Kumar V, Kumar N. Minor millets as a source of nutrient and health: A review. J Pharmacogn Phytochem. 2017;6(6):2178-2181.
10. Singh BP, Krishnamoorthi A, Kumar V, Kalaiselvi P. Revolutionizing and Agriculture Farming Through Artificial Intelligence. J Divers Stud. 2024. https://doi.org/10.51470/JOD.2024.03.01.13
11. Mausch K, *et al*. Finger millet and its nutritional values - a review. Schriftenreihe des Lehrstuhls für Agrar- und Ernährungsethnologie. 2017;11:69-80.
12. Sahoo SK, Kaladhar K. Health benefits and utilization of minor millets: A review. J Pharmacogn Phytochem. 2020;9(1):2188-2191.
13. UN. Transforming our world: The 2030 Agenda for Sustainable Development. New York: United Nations; 2015.
14. Hanumanta D Lamani, VijayKumar R, Lembisana Devi H, Parveen S. Climate Crisis Chronicles: Understanding Global Warming's Impact and Solutions. J Divers Stud. 2024. https://doi.org/10.51470/JOD.2024.03.01.37
15. Ashokri HAA, Abuzririq MAK. The impact of environmental awareness on personal carbon footprint values of biology department students, Faculty of Science, El-Mergib University, Al-Khums, Libya. In: Acta Biol Forum. V02i02. Vol 18.; 2023:22.
16. Wani SP, *et al*. Millets: Nutritional composition, opportunities, and challenges for genetic improvement. Agric Res. 2018;7(3):237-244.
17. Yacob W, *et al*. Millets: An opportunity for profitable, climate resilient, and nutritional food system. J Cereal Sci. 2020;92:102905.
18. Azeez MA, *et al*. Proximate composition, functional properties and nutraceutical potential of minor millets: A review. J Pharmacogn Phytochem. 2020;9(1):1281-1286.
19. Bhargava A, Shukla S. Minor millets - a potential nutraceutical for improved health. J Pharmacogn Phytochem. 2020;9(1):499-502.
20. Singh AK, Yadav N, Singh A, Singh A. Stay-green rice has greater drought resistance: one unique, functional SG Rice increases grain production in dry conditions. Acta Bot Plantae. 2023;2(31):38.
21. Devi PB, *et al*. Health benefits of finger millet (*Eleusine coracana* L.) polyphenols and dietary fiber: A review. J Food Sci Technol. 2014;51(6):1021-1040.
22. Saraswathi Ramavath, Rajani Bogarapu. A Study on Diversity and Distribution of Purple Non-sulfur Bacteria in Various Water Bodies. J Divers Stud. 2024. https://doi.org/10.51470/JOD.2024.03.01.08
23. FAO. Climate-smart agriculture sourcebook. Rome: Food and Agriculture Organization of the United Nations; 2016.
24. FAO. The future of food and agriculture: Alternative pathways to 2050. Rome: Food and Agriculture Organization of the United Nations; c2018.
25. Gupta RK, Srivastava N. Minor millets: Potential functional food grains. J Nutr Food Sci. 2019;9(4):1000759.
26. Shaista Tabassum S, Ramesh M, Haq J, Shamshad MS. Health Status of Scheduled Tribes of 3 ITDA Spots of Kurnool District, Andhra Pradesh, India. J Divers Stud. 2024. https://doi.org/10.51470/JOD.2024.03.01.01
27. Jyothi AL, *et al*. Review on nutritional properties, chemical composition, processing and utilization of finger millet in food industry. J Food Sci Technol. 2015;52(12):6539-6549.
28. Fatima S, Nausheed R, Hussain SM, Fatima I, Begum N, Siddi-qua R. Assessment of Soil Fertility Status of Mango Orchard at Vikarabad Farmhouse in Manneguda Village of Telangana State) Acta Bot Plantae.
29. Kumar A, Metwal M. Small millets: A review on importance, utilization and processing. Trends Biosci. 2020;13(25):3213-3218.
30. Mal J, Shankar D. Nutritional and therapeutic potential of minor millets. Asian J Dairy Food Res. 2020;39(4):293-300.
31. Nambiar VS, Dhaduk JJ. A comprehensive review on finger millet: Nutritional, physiological and health perspectives. J Food Sci Technol. 2019;56(2):823-831.
32. Reddy NR, *et al*. Nutritional and health benefits of millets. Crit Rev Food Sci Nutr. 2015;55(9):1266-1283.
33. Ogori AF, Eke MO, Girgih TA, Abu JO. Influence of aduwa (Balanites aegyptiaca. del) meal protein enrichment on the proximate, Phytochemical, Functional and Sensory Properties of Ogi. Acta Bot Plantae. 2022;1(3):22-35.
34. Roy P, *et al*. A review on potential nutraceutical applications of finger millet [*Eleusine coracana* (L.) Gaertn.] polyphenols. Int J Green Pharm. 2015;9(3):166-175.
35. Sharma RK, Rao DS. Nutritional and therapeutic potential of millets. Int J Res Stud Biosci. 2016;4(1):42-48.
36. Upadhyaya HD, *et al*. Millets: Genetic and genomic resources. Cham: Springer; 2019.
37. Vanaja T, Sumathi S. Minor millets: A nutritional powerhouse. Int J Chem Stud. 2019;7(4):3864-3867.
38. Nweze CC, Muhammad BY. Comparative Biochemical Effects of Natural and Synthetic Pesticides on Preserved Phaseolus vulgaris in Male Albino Rats. Acta Bot Plantae. 2023;2:01-10.
39. Vinayaka KS, *et al*. Nutritional and nutraceutical potential of finger millet (*Eleusine coracana* L.): A review. J Food Sci Technol. 2021;58(2):491-500.
40. Wani SP, Patancheru RS. Systems for sustainable intensification of crop-livestock farming systems: Rationale and approach for development. J Crop Improv. 2014;28(4):484-501.
41. Zinta G, Saxena RK. Genetic improvement of minor millets: A review. Agron Sustain Dev. 2016;36(2):24.