

Millets as the Diet of Tomorrow: Nutritional, Environmental, Economical and Sustainable Prospective

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Abstract

In the area of nutrition, millets are emerging as a promising component of future diets, with climate resilience and sustainability. Millets are ecofriendly at a time when the world is grappling with issues regarding food security, malnutrition and climate change. Yet Chhattisgarh is rich in millet potential, especially in terms of its agronomic, agroclimatic conditions and traditional practices. The nutritional benefits of millets, their role in sustainable agriculture and the efforts by Chhattisgarh in millets cultivation and consumption are covered in this paper. The socio-economic and environmental impacts; the study demonstrates how millets can respond to regional food security challenges while adding its thrust to global health goals. In a world struggling to cope with challenges around food security, malnutrition and climate change, millets provide an eco-friendly solution. India, a country with diverse agriculture, has special potential for millet production, especially given its favourable agro-climatic conditions and traditional practices, especially in the state of Chhattisgarh. The study analyses how millets can address the socio-economic and environmental impacts to address the regional food security issues and also contribute to the global health goals. The research demonstrates that Chhattisgarh has the potential to spearhead the revival of millet bases diets, which can act as a guiding light for other areas.

Keywords: Millets, Nutritional, Environmental, Economical and Sustainable, Agro-Climate, Chhattisgarh.

1. INTRODUCTION

Millets have a long and rich history in India, dating back to ancient times. Ancient texts like the Veda, Purana, and Samhita provide insights into the cultivation and consumption of diverse millet species. The research highlight's role of Chhattisgarh state in the revival of millet-based diet and looks at how other areas can follow suit. Given their high nutritional value, climate resilience and sustainability, millets are on the radar to become components of future diets. This paper looks at the nutritional value of millets, their role in sustainable agriculture and the work being done in Chhattisgarh to encourage millet cultivation and consumption. The review by Veerabadhran et al 2023, critically examines the historical significance and traditional uses of millets in India. Drawing from ancient Indian texts like the Vedas, Puranas, and Samhitas, the authors trace millet cultivation and consumption from prehistoric times through various

historical periods. The review systematically compiles information on over 28 millet species, detailing their mention in religious texts, archaeological findings, and Ayurvedic classifications, including their properties and therapeutic applications. Ultimately, the article underscores the enduring importance of millets as a nutritional, sustainable, and culturally relevant food source in India (Veerabadhran et al. 2023). This historical evidence underscores the crucial role millets have played in India's agricultural and dietary landscape for millennia. Millets is a generic term for a heterogeneous group of forage grasses known for their small coarse grain (Weber and Fuller 2008). Millets are small seeded, annual cereal grasses, many of which are adapted to tropical and arid climates and are characterized by their ability to survive in less fertile soil (Shobana et al. 2013). In India, millets can be categorized into two primary groups: major millets and minor millets. The major millets include Finger millet, Pearl millet, and Jowar, while the minor millets comprise Foxtail millet, Kodo millet, little millet, Brown top millet, Barnyard millet, and Proso millet (Ashoka, Gangaiah, and Sunitha 2020). Millets, often termed Nutri-cereals, are a “Smart Food” as they are not only highly nutritious but target some of the highest malnutrition problems (Alekhya and Shravanthi 2019). While single crops such as rice and wheat can provide food security for India, millets provide multiple security options, millets include food, nutrition, fodder, Fiber, health, livelihood, and environmental security (Bommy and Maheswari 2016).

The National Year of Millets 2018 was an initiative by the Government of India to promote the cultivation, consumption, and awareness of millets. Following the success of the National Year of Millets in 2018, India further advocated for the recognition of 2023 as the International Year of Millets, which was accepted by the United Nations General Assembly.

The Bastar Division is situated in the southern corner of Chhattisgarh, is home to a diverse array of tribal groups, each with their unique culture practices and traditional livelihoods (Hacker 2000). As a tribal region, Chhattisgarh has a long history of Finger Millet (Ragi), Little Millet (Kutki), and Arke millet (Kodo). As per “Ministry of Food Processing Industries Government of India” the state has approx. 69,000 hectares of millet cultivation area. To support farmers, the Chhattisgarh government purchased 52730 quintals of millets under the millet mission in 2020–2021, 2021–2022, and 2022–2023. The state government also announced plans to offer a midday meal program in schools and nutritious food made from millets in Anganwadi centres. Additionally, the State Government has set up Rs 10,000 per acre for farmers who choose to grow Kodo-Kutki rather than paddy.

2. OBJECTIVES & METHODOLOGY OF THE RESEARCH PAPER

OBJECTIVES

1. **Nutritional Analysis of Millets:** To evaluate the nutritional profile of millets, their potential to combat malnutrition and explore their benefits as a source of essential vitamins, minerals, and dietary fiber.
2. **Sustainability in Agriculture:** To assess the role of millets in promoting sustainable agriculture, especially under changing climatic conditions and examine their climate-resilient nature and ability to thrive in water-scarce and low-fertility soils.
3. **Economic Impact:** To investigate the economic benefits of millet cultivation for farmers, particularly in the tribal regions of Chhattisgarh and explore government initiatives, such as subsidies and support mechanisms, that enhance millet production and market accessibility.
4. **Environmental Contributions:** To analyze the environmental advantages of millet farming, including lower water requirements, reduced greenhouse gas emissions and advocate for millet cultivation as a means of mitigating climate change effects.

5. **Regional and Global Food Security:** To explore the role of millets in addressing regional food security challenges in Chhattisgarh, their potential contribution to global health goals and highlight the traditional and cultural importance of millets in Indian diets.
6. **Policy and Program Evaluation:** To review government policies and programs, such as the Millet Mission, and their effectiveness in promoting millet-based diets and farming practices and suggest improvements in market linkages, processing infrastructure, and public awareness campaigns.
7. **Promoting Millets as a Staple:** To position millets as a viable alternative to staple crops like rice and wheat, emphasizing their health and ecological benefits, recommend strategies for integrating millets into public food systems, such as midday meal schemes and the Public Distribution System (PDS).

METHODOLOGY

Figure 1- Millet Review and Analysis

Characteristic	Primary Focus	Regional Contextualization	Thematic Integration
 Source of data Selection	Credible publications, reports, institutional data	Insights from millet-growing regions	Prior research findings, studies, data
 Case Study Analysis	Broad array of research articles	Chhattisgarh as a focal point	Comparative tables of millet varieties
 Comparative Analysis	Policy documents and reports	Insights from other regions integrated	Studies on drought and water usage
 Policy Evaluation	Historical records and ancient texts	Government initiatives and best practices	Socio-economic studies of millet farming

a. Literature Review

• Primary Focus

The study systematically reviews the nutritional, environmental, economic, and sustainability aspects of millets, drawing on a broad array of research articles, reports, and policy documents.

• Source of data Selection

Credible academic publications, government reports, and institutional data were utilized to provide a robust basis for the discussion. Key sources include

- Historical records and ancient texts, such as the Vedas, regarding millet cultivation in India.
- Recent studies on millet's role in addressing malnutrition, food security, and climate resilience.
- Regional and national reports on millet production and policy interventions.

• Data Categorization

Information was categorized into key themes: nutritional value, environmental sustainability, socio-economic benefits, and regional practices, especially in Chhattisgarh.

b. Regional Contextualization

• Case Study Analysis

The study emphasizes Chhattisgarh as a focal point, exploring its unique agro-climatic conditions, tradi-

tional millet practices, and government initiatives like the Chhattisgarh Millet Mission.

- **Comparative Analysis**

Insights from other millet-growing regions, such as Karnataka, were integrated to highlight best practices and potential applications for Chhattisgarh.

- c. **Thematic Integration**

- **Nutritional Analysis:** The paper synthesizes data on the nutrient profiles of different millet varieties (e.g., Finger Millet, Foxtail Millet) using comparative tables and prior research findings.
- **Environmental Sustainability:** Studies on millet's resilience to drought and low water usage were reviewed to substantiate claims about its role in sustainable agriculture.
- **Economic Assessment:** Socio-economic studies were analyzed to understand the financial implications of millet farming and its impact on rural livelihoods.
- **Policy Evaluation:** Government initiatives such as the National Year of Millets (2018) and the International Year of Millets (2023) were reviewed for their implementation outcomes and strategic relevance.

- d. **Data Synthesis**

- The gathered data was synthesized to draw comprehensive conclusions about the potential of millets in tackling food security, malnutrition, and environmental challenges.
- Quantitative data on millet production, nutrient content, and economic viability was juxtaposed with qualitative insights from policy documents and cultural practices.

3. MILLETS: A POWERHOUSE OF NUTRITIONAL AND WELLNESS

Millets, often referred to as ancient grains, are small-seeded cereals that have been cultivated for thousands of years. In recent times, they have gained recognition as a nutritional powerhouse, offering numerous health benefits. Traditionally grown in arid and semi-arid regions, millets are climate-resilient, making them a valuable crop for sustainable agriculture in the face of climate change. The primary varieties of millets include pearl millet (bajra), finger millet (ragi), sorghum (jowar), and foxtail millet. Millets are lauded as “smart food” due to their resilience in drought-prone areas and their lower water requirements compared to other staple grains like wheat and rice (Gupta and Tiwari 2024). They are rich in dietary fiber, minerals, and vitamins, often deficient in the Indian diet (Pradhan, Nag, and Patil 2010). Finger millet, for instance, contains eight times more calcium than other cereals (Pradhan et al. 2010). “Health promising nutritional millets (kshudra dhanya) for cardiovascular diseases and its modifiable risk factors: an evidence-based overview” the studies highlight the heart-healthy benefits of millets, showing that their consumption can lower cholesterol, improve blood sugar levels, and support overall cardiovascular health due to their low glycemic index and high fiber content (Raj Saroj, Desai, and Kumar Garg 2024).

Millets also possess highly favourable nutritional attributes. The grains are rich in protein with balanced amino acids, dietary fiber, polyphenols, vitamins, and essential minerals such as iron, zinc and calcium. The majority of millets have a low glycemic index, which helps regulate blood glucose levels (Raj Saroj et al. 2024). In the paper “Nutritional and Nutraceutical Properties of Millets: A Review” researcher has studied that Millets are considered as rich source of energy, carbohydrate, and protein and are comparable to other cereals but have more fat, calcium, iron, dietary fiber, and Vitamin E (tocopherols and tocotrienols) content. These are found to be rich sources of phytochemicals such as phenolic acids, flavonoids, catechins, phytic acid, and phytosterols. Researchers have reported that the presence of dietary fiber and phenolic compounds help in the prevention of many diseases such as diabetes, cardiovascular diseases,

and cataractogenesis. These phytochemicals are reported to have antioxidant and antimicrobial properties also (Chauhan, Sonawane, and Arya 2018). Millets low glycemic index helps stabilize blood sugar levels, making them beneficial for managing diabetes. In the paper “A Review of the Nutraceutical Composition of Millets and their Health Benefits” researcher have studies and concluded that bioactive compounds in millets, like flavonoids and phenolic acids, offer anti-inflammatory benefits and help mitigate the risks of various diseases, including certain cancers and neurological disorders (Awasthi et al. 2024). Following is the Table 1. Nutrients content in different types of millets (Ashwin Porwal et al. 2023; Pradhan et al. 2010)

Table 1 - Nutrients content in different types of millets

Nutrient	Pearl Millet	Finger Millet	Sorghum	Foxtail Millet
Protein (g)	11.6	7.3	9.7	12.3
Carbohydrates (g)	67.0	72.9	75.5	60.9
Fiber (g)	8.5	3.6	6.7	9.8
Fat (g)	4.0	1.3	3.0	5.2
Calcium (mg)	42	344	28	31
Magnesium (mg)	114	114	121	137
Phosphorus (mg)	285	344	287	298
Potassium (mg)	348	408	350	330
Zinc (mg)	2.9	3.9	2.7	2.4

On the basis of above table, we can conclude that Each millet has its unique strengths:

- Foxtail Millet is best for protein and fiber.
- Finger Millet is unmatched in calcium, phosphorus, potassium, and zinc content.
- Sorghum and Pearl Millet are balanced in terms of carbohydrates and minerals but are slightly lower in calcium compared to Finger Millet.

For those aiming to boost bone health (high calcium and phosphorus), Finger Millet is ideal. For digestive health (high fiber) and protein, Foxtail Millet would be preferable. Sorghum provides a good energy source with a high carbohydrate content.

This combination of nutritional benefits and health advantages has led to a growing recognition of millets potential to address malnutrition and promote healthier dietary choices (Ashwin Porwal et al. 2023; Gupta and Tiwari 2024).

4. MILLET FARMING IN CHHATTISGARH: AN OVERVIEW

The adaptable nature of millets allows them to grow in low-water conditions, making them a sustainable agricultural choice, especially as climate change worsens. Research indicates that shifting from water-intensive crops like rice to millets can enhance climate resilience, reduce greenhouse gas emissions, and improve food security, particularly in drought-prone areas (Kumar et al. 2022). Millet farming plays a crucial role in sustaining tribal populations in Chhattisgarh, particularly in the Bastar region (Verma and Banafar 2013). Despite its importance, millet productivity in the area remains low due to traditional farming practices and lack of high-yielding varieties (Kumar Thakur, Kumar, and Yadav 2017). However, frontline demonstrations have shown that improved practices can significantly increase yields (Kumar Thakur et al. 2017). Millets are not only nutritionally superior to other cereals but also have diverse uses, including medicinal applications, animal treatment, and construction (Sahu and Sharma 2013). These

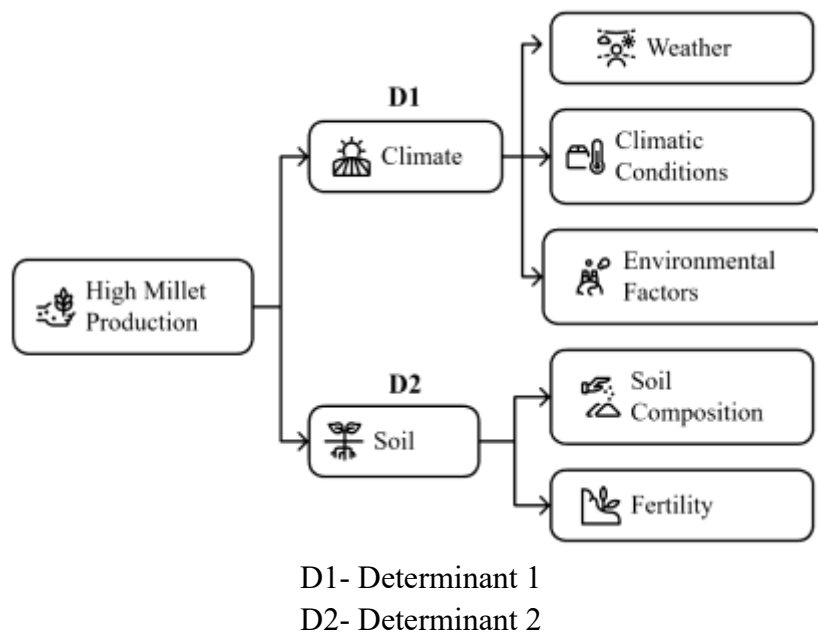
crops are well-suited to adverse conditions and are often grown alongside legumes and oilseeds in rainfed, multi-cropping systems (Chandel et al. 2014). Despite their potential to combat malnutrition, minor millets remain underutilized due to processing challenges and lower cooking quality (Chandel et al. 2014). To promote millet cultivation, it is essential to implement production system approaches and establish minimum support prices (Verma and Banafar 2013).

Government of Chhattisgarh launched Mission Millet Chhattisgarh in September 10, 2021 to become the Millet Hub of India by 2023. Its primary objective is to promote cultivation of Kodo millet, little millets and Finger millet in the State, with a focus on 85 Blocks in 20 Districts with the total budgetary allocation of Rs.170 Crores and input grant of Rs.9000 per hectare was decided. Chhattisgarh Minor Forest Produce Co-operative Federation was appointed as the implementing agency for procurement and processing of millets in the State. Agreement between ICARI-IMR and 14 district administrations, for promotion of cultivation, procurement storage and processing into value added products, was signed in presence of Hon'ble CM on September 10th, 2021 (Rajib kumar sen et al ,2023).

5. DETERINANTS OF HIGH MILLET PRODUCTIVITY IN CHHATTISGARH

Millets are increasingly recognized as a viable agricultural option in Chhattisgarh due to their resilience to climatic challenges and environmental factors. These crops grow under conditions of water stress, drought, and poor soil quality, making them suitable for the regions unpredictable weather patterns. The following sections outline the key aspects of millet cultivation in Chhattisgarh.

Figure 2 – Determinants of High Millet Production



5.1 CLIMATE

5.1.1 Weather Patterns and Agricultural Viability

The agriculture viability of millets in Chhattisgarh is significantly influenced by the regions weather patterns, which have become increasingly erratic due to climate change. The state receives the majority of its rainfall from the southwest monsoon, accounting for around 87 percent from June to September (Kurrey, Pathak, and Choudhary 2023) . However, there is considerable variability in rainfall, particularly

in June and September, where the coefficient of variation is around 33 and 30 percent, respectively (Kurrey et al. 2023). This inconsistency in rainfall patterns poses a challenge for traditional agriculture, making it less reliable.

Millets, being climate-resilient crops, offer a viable alternative for farmers in Chhattisgarh. They are well-suited to thrive under changing ecological conditions due to their low water requirements and resistance to environmental stresses (Bezbaruah and Singh 2024). Additionally, millets have a shorter life cycle compared to crops like rice and wheat, allowing them to escape the adverse effects of erratic weather patterns (Bezbaruah and Singh 2024). This makes them a strategic choice for ensuring food and nutrition security in the face of climate change. Farmers in other regions, such as Karnataka, have already started shifting to drought-resistant millets instead of more water-intensive crops like rice and sugarcane due to similar climatic challenges (Bezbaruah and Singh 2024). This trend underscores the potential for millet cultivation in Chhattisgarh as well.

Furthermore, the utilization of advanced agricultural technologies and timely weather information can enhance the productivity and sustainability of millet farming. For instance, implementing deep learning approaches for weather image recognition can help provide precise weather forecasts, enabling farmers to make informed decisions about their agricultural practices (Mashudi et al. 2022). This integration of technology can further support the adoption of millets by providing reliable data on weather conditions.

In summary, the adoption of millets in Chhattisgarh can mitigate the risks posed by erratic weather patterns and enhance agricultural viability. Their climate-resilient nature, combined with advanced weather forecasting technologies, can support sustainable agriculture in the region (Kurrey et al., 2023) (Mashudi et al., 2022) (Bezbaruah & Singh, 2024).

5.1.2 Climatic Conditions

Millets are recognized for their resilience to water stress, rendering them appropriate for the fluctuating rainfall patterns of Chhattisgarh (Chellapilla, Ambawat, and Gurjar 2022)

(Maitra et al. 2024). They need less water and nutrients than standard crops like rice, which lets them grow well in less-than-ideal circumstances (Bezbaruah and Singh 2024).

5.1.3 Environmental Factors

Millets are able to keep yields stable even if average temperatures rise by 3 to 4 degrees Celsius due to climate change (Bezbaruah and Singh 2024) (Chellapilla et al. 2022).

5.2 Soil

5.2.1 Soil Composition and Fertility

The soil in Chhattisgarh has a pH range of 6.60 to 8.22, indicating neutral to slightly alkaline conditions, which are suitable to millet cultivation. Key nutrients such as nitrogen (100-204 kg/ha), phosphorus (5.4-39.5 kg/ha), and potassium (277.31-484.96 kg/ha) are present, essential for millet development. Organic carbon levels are around 0.49%, which is crucial for maintaining soil fertility and structure (Tarar et al. 2023). Following is the Table 2. Of Agro-Climatic Requirement and Seasonal Characteristics of Major Millet Tyes (Gupta and Tiwari 2024).

Table 2 - Agro-Climatic Requirements and Seasonal Characteristics of Major Millet Types

Millet Type	Temperature Range (°C)	Rainfall (cm)	Planting Season	Harvesting Season	Sensitivity to Weather Conditions
Foxtail Millet (Setaria italica)	25–30°C	50–75 cm	Monsoon season (June–July)	September–October	Moderate sensitivity to excessive rainfall and humidity, risk of fungal diseases
Kodo Millet (Paspalum scrobiculatum)	20–32°C	40–60 cm	Monsoon season (June–early July)	October	Resistant to drought; sensitive to prolonged humidity during flowering, which can reduce yield quality
Little Millet (Panicum sumatrense)	22–30°C	40–60 cm	Monsoon season (June)	September–October	Highly resilient to drought; moderately sensitive to excessive rain, which can cause lodging or crop failure

6. Land Use and Agricultural Output

Chhattisgarh, a state in central India, has been increasingly focusing on millet cultivation as part of its agricultural strategy. This initiative is driven by the Chhattisgarh Millet Mission, which aims to enhance the production and consumption of millets, particularly in tribal areas. Below is an overview of land use for millets and their agricultural output in the state.

As per the public bureau, the area under cultivation of millets has ranged from 12.29 to 15.48 million hectares from 2013-14 to 2021-22.

Table 3 - Millet Cultivation Performance

Name of millet	2021-22			2022-23			2023-24	
	Area (Ha.)	Production (Quintal)	Yield (Kg/Ha.)	Area (Ha.)	Production (Quintal)	Yield (Kg/Ha.)	Targeted Area (Ha.)	Actually, sown area (Ha.)
Kodo	30113	196383	652	48180	345451	717	60000	52140
Kutki	42894	254392	593	30570	181586	594	50000	38810
Ragi	20570	141220	686	43640	394069	903	50000	38590
Other millets	0	0	0	18620	100548	54	1000	580
Total	93,577	5,91,995		1,41,010	10,21,654		1,61,000	1,30,120

Source: Millet Mission, Document of Agriculture Department, Government of Chhattisgarh

7. Market Support

Figure 3 – Determinants of High Millet Production



7.1 Market Accessibility and Support Systems

The market accessibility and support systems for millets in Chhattisgarh are influenced by several factors. Chhattisgarh has launched Millet Missions to encourage millet cultivation, research, and consumption, which underscores the state's commitment to promoting millets (Pathak, Kiran, and Gauraha 2023). However, a regional-scale assessment indicates that regions with poor access to markets and supporting infrastructures, such as roads and storage facilities, are potentially ill-equipped to deal with both short-term hydrometeorological hazards and longer-term shifts in agricultural productivity (Cooper and Shankar 2024). This is particularly relevant for Chhattisgarh, as it is one of the Indian states identified with relatively high climate vulnerability and multidimensional market inaccessibility (Cooper & Shankar, 2024). To address these challenges, integrating millets into the Public Distribution System (PDS) and establishing millet cafes across all cities in Chhattisgarh are recommended strategies to increase millet consumption at the household and community levels (Pathak et al. 2023). These efforts aim to improve market accessibility for millets, ensuring that they reach a wider consumer base and support sustainable farming practices (Pathak et al. 2023).

7.2 Supply Chain and Marketing Infrastructure

Chhattisgarh has emerged as a significant player in millet cultivation, particularly for varieties like kodo, kutki, and ragi. The state's efforts are encapsulated in the “Chhattisgarh Millet Mission”, launched in 2021, which aims to promote millets as a staple crop and enhance the livelihoods of farmers in tribal and rural areas. The Chhattisgarh Millet Mission is a comprehensive initiative with a budget allocation of ₹170 crores over five years. Its objectives include:

a. Promoting Cultivation

Focused on 85 blocks across 20 districts, the mission aims to increase millet production and improve farmer's incomes through incentives such as ₹9,000 per hectare under the Nyuntam Aay Yojana (NYAY) (Babu, Tandon, and Pandey 2023).

b. Infrastructure Development

Establishment of cleaning, grading, and dehulling units to facilitate processing. Approximately 50 cleaning and grading units and 10 dehulling units have been set up by the Chhattisgarh Minor Forest Produce Cooperative Federation (Babu et al. 2023).

c. Training and Technical Support

Collaborations with institutions like the Indian Institute of Millets Research (IIMR) provide training to farmers on modern agricultural practices.

7.3 Supply Chain Challenges

Despite these initiatives, several challenges persist in the millet supply chain:

- a. **Inconsistent Supply and Demand:** There is a lack of stable market demand for millets, which affects procurement rates and pricing. Government procurement for millets remains low compared to staple grains like wheat and rice.
- b. **Processing Limitations:** The short shelf life of processed millet products (20-30 days) complicates marketing efforts. Small processors often face high costs due to the need for specialized processing equipment.
- c. **Market Awareness:** There is limited public awareness regarding the nutritional benefits of millets, which hinders their adoption as a mainstream food source.

7.4 Marketing Infrastructure: To enhance the marketing infrastructure for millets, several strategies are being implemented:

- a. **Public Distribution System (PDS):** Incorporating millets into PDS aims to increase consumption among low-income households.
- b. **Value Addition Initiatives:** The government encourages value-added products from millets, such as ready-to-eat and ready-to-cook items, to boost market appeal.
- c. **Farmer Producer Organizations (FPOs):** FPOs are being promoted to facilitate collective marketing efforts among farmers, ensuring better price realization for their produce.

7.5 Future Directions

To solidify its position as a “Millet Hub” Chhattisgarh must address existing supply chain inefficiencies. This includes:

- a. Increasing public procurement rates for millets.
- b. Expanding training programs for farmers on sustainable practices.
- c. Enhancing infrastructure for processing and storage to improve product shelf life.

By overcoming these challenges, Chhattisgarh can not only improve the economic conditions of its millet farmers but also contribute significantly to national food security and nutritional diversity.

7.6 Market Linkages and Farmer Support

Market linkage and market support for millets in Chhattisgarh are crucial for promoting the crops cultivation and consumption. The state government has initiated the Millet Mission to provide farmers with the right price for small cereal crops and input assistance.

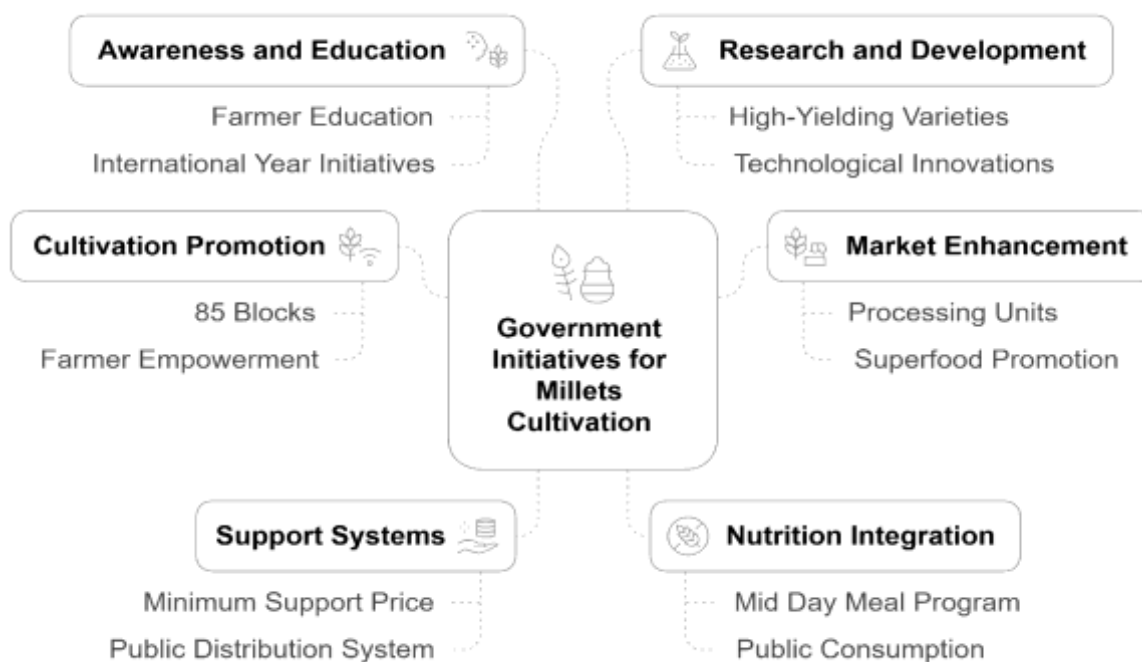
To strengthen market linkages, several strategies can be employed:

- a. **Developing a Decentralized Processing Infrastructure:** Encouraging processes that aid drudgery reduction, produce aggregation, and shortening the local value chain can help millet farmers.
- b. **Linkages with Marketing Institutions:** Developing linkages with marketing institutions, development agencies, and organizations like the Agricultural and Processed Food Products Export Development Authority (APEDA) can facilitate market access.
- c. **Farmer Producer Organizations (FPOs):** FPOs can play a vital role in promoting millet cultivation and marketing. They can provide training, inputs, and market access to farmers.
- d. **Start-ups and Value Addition:** Start-ups can help add value to millets, making them more attractive to consumers. This can include processing, packaging, and branding (Dholi, Laxmi, and Pattanaik 2022).
- e. **Minimum Support Price (MSP):** Ensuring a fair MSP for millets can encourage farmers to cultivate the crop. The government has declared procurement at MSP for certain millet varieties ².

By implementing these strategies, Chhattisgarh can strengthen market linkages and support for millets, promoting the crops cultivation and consumption.

8. GOVERNMENT POLICIES AND INITIATIVES

Figure 4 – Government Policies and Initiatives



The government of Chhattisgarh, along with the central government, has launched several policies and initiatives to promote millet cultivation, processing, and consumption. These efforts aim to enhance agricultural sustainability, improve farmers income, and address nutritional security. FAO (Food and Agriculture Organisation of United Nations) and ICAR-IIMR held an international webinar on millet development in India on April 18, 2024, with 70+ global participants. The event was part of FAOs OCOP (One Country One Priority Product) initiative, which designated millets as Indias special agricultural product. This aligns with Indias ODOP (One District One Product) program and aims to promote sustainable millet production, boost farmer income, and improve food security. Below is an overview of the key government policies and initiatives for millets in Chhattisgarh:

a. Inclusion in the Millet Mission

Millet Mission: The Chhattisgarh government has implemented several policies and initiatives to promote millet cultivation, particularly through the “**Chhattisgarh Millet Mission**”, launched in September 2021. This mission aims to establish Chhattisgarh as a “Millet Hub” in India, focusing on the cultivation of kodo millet, little millet, and finger millet across 85 blocks in 20 districts with a budget allocation of ₹170 crores over five years (Babu et al. 2023)

b. Millet Processing Units and Infrastructure Development

- The state is investing in the establishment of millet processing units and value-addition facilities to enhance the marketability of millet products. In October 2022, the Chhattisgarh government inaugurated Asias largest millet processing unit in Kanker district, established by Avni Ayurveda. With

an annual processing capacity of 10,000 to 12,000 tonnes, the unit marks a significant milestone in millet production.

- Financial assistance is provided to entrepreneurs and farmer-producer organizations (FPOs) for setting up these units. Under RKVY-RAFTAARs value-addition component, states can implement agribusiness models that ensure additional farmer income through end-to-end processes from production to marketing. For instance, in rain-fed millet areas, Farmer Producer Organizations (FPOs) can grow millets, leverage ICAR technology for value-added products, and partner with private firms for marketing. Such projects, following PPP-IAD guidelines, ensure assured income growth for farmers.

3. Procurement at Minimum Support Price (MSP)

- The state government procures millets like kodo and kutki at a minimum support price to ensure that farmers get a fair price for their produce.
- MSP for millets is revised periodically to encourage their cultivation. The support price of Kodo was increased from Rs 3000 per quintal to Rs 3200 per quintal and the support price of Kutki was increased from Rs 3100 per quintal to Rs 3350 per quintal. Ragi crop will be procured as per the minimum support price of Rs 3846 per quintal.

4. Promotion through Public Distribution System (PDS)

- The government has introduced millets into the Public Distribution System (PDS) to promote their consumption among the general public.
- This step is aimed at improving nutritional security, especially in rural areas.

5. Millets in Mid-Day Meal Scheme

The state government has announced plans to provide millet-based nutrition food in Anganwadi centers, schools, hostels, jails, and police lines

6. Awareness Campaigns and Training Programs

- Awareness programs are conducted to educate farmers about the benefits of millet cultivation, such as drought resistance, low input costs, and high nutritional value.
- Training programs focus on modern farming techniques, post-harvest management, and marketing strategies.

7. Integration with Other Schemes

- Millets are integrated with other flagship programs like the National Food Security Mission (NFSM) and the Rastriya Krishi Vikas Yojana (RKVY) for funding and implementation. These efforts have led to an increase in millet production from 14.52 MT in 2015-16 to 17.96 MT in 2020-21 (Pandey, Bharti, and Bharti 2023).
- These schemes provide subsidies for inputs, irrigation facilities, and crop insurance.

8. Promotion of Millets as a Superfood

- Campaigns are conducted to position millets as a “superfood” due to their high nutritional value.
- The state government collaborates with health experts, chefs, and nutritionists to popularize millet-based recipes and products.

9. Support for Research and Development (R&D)

- The government encourages agricultural universities and research institutes to develop high-yielding and climate-resilient millet varieties.
- R&D efforts also focus on improving storage and processing technologies.

- The Chhattisgarh government has signed an MoU with the Indian Institute of Millets Research, Hyderabad, to promote millet research and development

10. International Year of Millets (2023) Initiatives

- In alignment with the United Nations declaration of 2023 as the International Year of Millets, the state government launched several programs to promote millet production and consumption.
- Activities included millet fairs, farmer meets, and international trade promotion events.

11. Support for Women and Tribal Farmers

- Special emphasis is placed on empowering tribal and women farmers who traditionally cultivate millets.
- Financial and technical support is provided to self-help groups (SHGs) involved in millet farming and processing.

These initiatives collectively aim to revive millet cultivation, improve the livelihoods of farmers, and address health and nutritional challenges in Chhattisgarh.

9. KEY OBSERVATION & STRATEGIC RECOMMENDATIONS

Millets, being resilient crops suitable for diverse agro-climatic conditions, hold significant potential for food security, nutrition, and livelihoods in Chhattisgarh. Key observations in the state reveal a low production base despite the suitability of local conditions, primarily due to limited market linkages, lack of awareness about millets nutritional benefits, and inadequate post-harvest infrastructure. Additionally, there is untapped potential for integrating millets into mainstream public distribution systems (PDS) and value-added products. Consumer awareness in urban areas like Raipur remains limited, with only 31% of participants reporting frequent millet consumption, despite recognition of health benefits and cultural significance (Pathak, Kiran, and Gauraha 2023). Challenges include disease susceptibility, as seen in finger millet varieties, necessitating targeted research for resistant cultivars (Netam et al. 2019). Innovative approaches like optimizing nitrogen levels and plant geometry have demonstrated potential in enhancing millet yields in specific zones (Thakur, Kumar, and Netam 2019). Additionally, cultivating smaller millets, such as Kodo, has shown positive trends in Kabirdham district, suggesting scalable opportunities for tribal livelihoods. To address these gaps, strategic recommendations include enhancing farmer training on millet cultivation practices and promoting improved seed varieties to boost yields. Establishing robust market linkages through cooperatives, farmer-producer organizations (FPOs), and private players can facilitate better price realization. Developing infrastructure for processing and storage is critical for reducing post-harvest losses and encouraging value addition, including ready-to-eat products and fortified foods.

The state government should strengthen procurement mechanisms by integrating millets into the PDS, mid-day meals, and other welfare schemes to drive demand. Public awareness campaigns on millet-based nutrition, supported by collaborations with NGOs and local health workers, can promote their consumption. To boost millet adoption, research and development efforts should focus on resilient, high-yield, and biofortified varieties suitable for Chhattisgarh's ecosystem. Encouraging private sector participation through incentives for millet-based enterprises and startups can accelerate innovations and market expansion. Policies supporting crop insurance and input subsidies for millet farmers will also mitigate risks and encourage adoption. Collectively, these interventions can elevate millets from a marginalized crop to a cornerstone of sustainable agriculture and nutrition in Chhattisgarh.

10. CONCLUSION

In conclusion, this research underscores the significant role of millets as a sustainable and nutritious food source in Chhattisgarh. The findings reveal that despite the favourable agro-climatic conditions for millet cultivation, production levels remain low due to inadequate market access, limited consumer awareness, and insufficient post-harvest infrastructure. The study emphasizes the urgent need for strategic interventions, including enhancing farmer training, improving market linkages, and integrating millets into public distribution systems. Additionally, there is a call for targeted research to develop resilient millet varieties and innovative cultivation practices. By addressing these challenges and promoting millets, Chhattisgarh can not only improve local food security and nutrition but also contribute to global health goals, positioning millets as a vital component of future diets.

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