Popular Article

DISCOVERING KODO MILLETS: NUTRITIONAL & ECONOMIC INSIGHTS

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ABSTRACT

As a traditional nutricereal, Kodo millet emerges as a powerhouse of essential nutrients, offering a viable alternative to conventional staples like rice and wheat. This article comprehensively explores the multifaceted attributes of Kodo millet (*Paspalum scrobiculatum*), delving into its nutritional richness, sustainable cultivation practices, economic significance, future prospects, and prevailing challenges. Its cultivation demonstrates sustainability, mitigating environmental impacts while ensuring food security in diverse agro-climatic conditions. Economically, Kodo millet holds promising market potential both domestically and internationally, driven by increasing consumer awareness and versatile culinary applications. Despite its promising future, challenges such as market awareness, agronomic improvements, processing techniques, and safety concerns warrant attention for its holistic integration into global food systems.

Keywords: Kodo millet, *Paspalum scrobiculatum*, traditional nutricereal, nutritional richness, sustainable cultivation, market potential, challenges

I. INTRODUCTION

Millets, often referred to as 'nutricereals', serve as functional foods and nutraceuticals. They are gaining much attention in present day situation due to their potential health benefits in combating various diseases and contribution to national food security. One of the ancient millets is Kodo millet (*Paspalum scrobiculatum*; family- Poaceae) which is also known as cow grass, rice grass, native Paspalum, Indian Crown Grass or ditch millet. It was believed to have originated in tropical Africa and domesticated in India around 3000 years ago. It is cultivated in diverse regions including India, Pakistan, Philippines, Indonesia, and West Africa. It serves as a staple food in the Deccan plateau of India and various other regions such as Gujarat, Karnataka, Maharashtra, Odisha, and West Bengal, where it is consumed traditionally. Madhya Pradesh, Maharastra and Tamil Nadu are the leading producers and promoters of kodo millet.

II. NUTRITIONAL ASPECTS OF KODO MILLLET

Millets stand out among grains due to their abundant calcium, dietary fiber, polyphenols, and protein content. They are also notable sources of magnesium and phosphorus, with magnesium aiding in migraine and heart attack prevention, and phosphorus playing a vital role in energy production. Kodo millet, known as "nutria-cereals," boasts a wealth of vitamins, minerals, and phytochemicals, including sulfur. It's particularly rich in essential amino acids like lysine and threonine, though it lacks tryptophan. Additionally, it's abundant in vitamin B3, B6, folic acid, and minerals like potassium and zinc. With 8.3% protein content, primarily glutelin, and high crude fiber compared to wheat, it offers 353 Kcal of energy per 100 gm. It offers a viable alternative to rice and wheat as it contains 9% fiber, in contrast to rice's 0.2% and wheat's 1.2%. Additionally, it exhibits notable

antioxidant properties due to the presence of phenolic compounds. The bound phenolic content of Kodo millet is reported to be 81.64 ± 0.15µmol of ferulic acid equiv/g of defatted meal. Consumption of millets has been linked to lower diabetes rates due to their phenolic compounds that inhibit enzymes involved in carbohydrate breakdown, reducing postprandial hyperglycaemia. Additionally, millets contain inhibitors that prevent sorbitol accumulation, reducing the risk of diabetes-related cataracts. The antioxidants and phenolics in millets, such as phytates, phenols, and tannins, contribute to their beneficial effects on aging and metabolic syndrome. These compounds also exhibit anti-cancer properties, reducing the risk of colon and breast cancer. Millets, being gluten-free, offer potential for celiac disease sufferers, opening up opportunities for novel and healthy food products. Furthermore, their high free radical scavenging activity lowers the risk of cardiovascular diseases, addressing a global concern exacerbated by factors like obesity and sedentary lifestyles. Millets offer a promising avenue for combating various health issues and versatile applications in various food products, with potential for enhanced nutritional value through legume protein supplementation make it the future super food for mankind.

Table.1 Nutritional composition of Kodo millet (Hadimani and Malleshi, 1993; Millets, 1995; Vijay *et al*., 2013; Devi, *et al*., 2014)

Nutrients	**Quantity (100gm)**
Carbohydrate	59.2 gm
Protein	10.6 gm
Fat	4.2 gm
Calcium	27 mg
Phosphorus	188 mg
Iron	0.5 mg
Fiber	10.2 gm
Niacin	2.0 mg

III. SUSTAINABILITY IN MILLET PRODUCTION

The Green Revolution in India revolutionized agriculture in the sixties, which heavily relied on chemical inputs leading to environmental degradation, polluting water bodies and depleting soil quality. Climate change exacerbates these issues, impacting crop production nationwide. Millets offer a sustainable solution, being climate-smart, requiring less water, and preserving soil health. Kodo millet cultivation is straightforward, employing traditional agricultural techniques with minimal input requirements of water and fertilizer. Its low environmental footprint and strong weed-suppressing qualities make it an eco- friendly option, reducing carbon emissions in agriculture. Notably, Kodo millet ensures food security and sustainable farming practices across various agro-climatic conditions, particularly in regions prone to climate fluctuations and water scarcity. The Athiyandal-based Centre of Excellence in Millets conducted a comprehensive study spanning from kharif 2020 to 2022. It aimed to assess the impact of conservation agriculture methods on small millet crops in rainfed regions. The experiment, employing various treatments including no tillage, minimal tillage, and mulching, revealed significant benefits such as reduced weed populations, improved grain and straw yields, and enhanced water use efficiency. Notably, mulching emerged as a particularly effective practice, promoting higher yields and sustainable alternatives to herbicide use in millet production. Sustainable farming practices play a vital role in enhancing the resilience and productivity of Kodo millet cultivation while minimizing environmental impact. For instance, crop rotation when implemented with legumes like pigeon pea, can boost soil nitrogen levels by 20-40 kg/ha, enriching the soil for subsequent crops. Inter-cropping Kodo millets with legumes such as cowpea or green gram not only increases total grain yield by 20-30% but also promotes biodiversity and reduces pest pressure.

Moreover, embracing organic farming methods in Kodo millet cultivation can lead to significant reductions in greenhouse gas emissions by up to 48% and energy use by 67% compared to conventional farming approaches. Agroforestry, integrates Kodo millets with nitrogen-fixing trees like *Gliricidia sepium*, which enhances soil fertility and biodiversity while providing additional income opportunities for farmers through the sale of timber or fruit.

III. ECONOMIC IMPORTANCE

Presently, in India Kodo millet spans approximately 907,800 hectares with an annual production of about 310,710 tonnes (Kavitha *et al*., 2021). The market demand for millet-based products, including Kodo millets, has been on the rise due to increased consumer awareness of their health benefits. The price of Kodo millets at the Indian mandi is around 225 rupees per kilogram. As per Procurement Resource, millets' export value peaked at $644 per metric ton in January 2022.According to market research, the global millet market is projected to grow at a CAGR of around 4.5% between 2021 and 2026.India is the leading global exporter of Kodo millet, with its major export destinations being the United States, United Arab Emirates, and Singapore (Source: Volza's India Export data). Kodo millets possess versatility, serving both traditional and innovative culinary purposes. Whether consumed whole or processed into flour through traditional or industrial means, they are utilized in various ways. In India, they are ground into flour for puddings or cooked like rice in tribal communities, with the flour being used for diverse recipes. Kodo millet flour serves as a versatile ingredient for various value-added products, ranging from traditional dishes like idli, dosa, and chapati to innovative items like biscuits, pasta, and extruded snacks. Its usage extends to snacks like papad, muruku, and pakoda, while also enhancing the nutritional profile of bakery items like biscuits and bread. Additionally, it contributes to gluten-free alternatives and enriched products like leavened bread and biscuits with increased protein content. Additionally, they serve as nutritious fodder for livestock.

IV. FUTURE TRENDS

Kodo Millet appears to have a promising future because of a number of important factors. Firstly, customers who are concerned about their health and are looking for gluten-free options are driving up demand for alternative grains. Secondly, Kodo millet is a crucial crop in methods for adapting to climate change due to its tolerance to unfavourable climatic conditions, particularly in areas vulnerable to unpredictable weather patterns. It is also an important crop in water-stressed areas due to its drought tolerant ability. Thirdly, in order to satisfy consumer desire for healthier and more varied options, food makers can diversify their product offerings by adding Kodo millet to cereals, snacks, and baked goods. Additionally, Kodo millet's adaptability for environmentally friendly farming methods corresponds with the increased emphasis on environmentally friendly agriculture, which may encourage farmers who use organic and agroecological farming to adopt it. Furthermore, initiatives to acknowledge and protect the cultural significance of Kodo millet may result in a greater understanding and admiration as culinary delight.

V. CHALLENGES

The broad cultivation and use of Kodo millet are challenged by a number of issues. First and foremost, a key barrier is the lack of market demand and knowledge in comparison to major cereal crops. Second, managing diseases and pests is still a challenge, necessitating continued study into practical mitigation techniques. Third, despite Kodo millet's resilience, it has a lower production potential than other major grains, therefore high-yielding varieties and improvements to agronomic methods are required. Fourth, in order to address the anti-nutrient content of Kodo millet, processing techniques such as soaking are required. Furthermore, because it

might lower blood glucose and cholesterol, possible interactions with specific medications, such as anti-diabetic and cholesterol-lowering ones, need to be taken into account. Finally, the possibility of Kodo poisoning from contaminated millets and the presence of goitrogens, which can cause thyroid problems, emphasize the difficulties and significance of quality control and safety procedures in the production and use of Kodo millet.

VI. CONCLUSION

Kodo millet is highly nutritious and sustainably farmed crop. Owing to its exceptional nutritional makeup and capacity to flourish in challenging environments, it has a pivotal role in tackling issues related to food security and health. Despite its enormous potential, a few obstacles need to be removed in order to fully realize its advantages. These include raising consumer knowledge and demand, controlling diseases and pests efficiently, and improving processing methods and agronomic practices. Furthermore, the necessity of quality control and possible drug interactions highlight the significance of thorough safety procedures and research initiatives. However, Kodo millet appears to have a bright future due to rising consumer interest in healthier food options and continuing advances in agricultural science. Utilizing its excellent nutritional value and cultural significance, Kodo millet holds the potential to transform the food sector and build a more resilient and sustainable agricultural system. By working together, farmers, researchers, policy makers and consumers can fully utilise the Kodo millet as a superfood for a healthier and more environmentally conscious food ecosystem.

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