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Comparative Physicochemical Profiling of Finger Millet (Eleusine coracana) and Pearl Millet (Pennisetum glaucum) Cultivars

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ABSTRACT

Millets have re-emerged as functional grains due to their rich nutrient composition and diverse bioactive constituents. This study presents a comparative physicochemical evaluation of selected cultivars of finger millet (Eleusine coracana) and pearl millet (Pennisetum glaucum) to determine their nutritional and nutraceutical significance. Standard analytical parameters, including loss on drying (LOD), total ash, acid-insoluble ash, water-soluble ash, pH, and water-soluble extractive values were assessed following WHO and pharmacopoeial guidelines. Finger millet cultivars RAU-8 and Indaf-9 exhibited higher mineral content and extractive values, indicating superior nutraceutical potential. Pearl millet cultivars Pioneer 86M86 and ICMH-356 displayed the highest total ash and aqueous extractive yields, suggesting greater concentrations of polar phytochemicals. Comparative analysis revealed that finger millet excels in mineral richness, whereas pearl millet demonstrates higher extractive potential.

Keywords: *Finger Millet, Pearl Millet, Physicochemical Analysis, Extractive Values, Nutraceutical Potential.*

1. INTRODUCTION

Millets are climate-resilient cereals that contribute significantly to global food and nutritional security. Among them, finger millet (*Eleusine coracana*) and pearl millet (*Pennisetum glaucum*) hold major agronomic and nutritional importance in India and other semi-arid regions. Finger millet is notable for its high calcium, iron, polyphenol, and dietary fiber content, making it an important food for preventing malnutrition and metabolic diseases. Pearl millet contains high levels of energy, iron, zinc, magnesium, and antioxidants, contributing to its anti-diabetic, cardioprotective, and anti-inflammatory properties.

Physicochemical parameters such as moisture content, ash values, pH, and extractive yields serve as critical indicators of grain quality, purity, bioactive constituent density, and suitability for processing. These parameters also provide a scientific basis for cultivar selection in food technology, pharmaceutical formulation, and nutraceutical development.

This study provides a detailed comparative physicochemical assessment of multiple cultivars of finger and pearl millet, establishing a foundation for their targeted utilization in value-added health products.

2. REVIEW OF LITERATURE

Finger millet contains exceptionally high calcium (~344 mg/100 g), iron, dietary fiber, and polyphenolic compounds, which contribute to its antioxidant, anti-diabetic, and anti-anemic properties (Chandra *et al.*, 2016; Devi *et al.*, 2014). Processing techniques such as germination and fermentation further enhance nutrient availability by reducing anti-nutritional factors.

Pearl millet is one of the most nutrient-dense cereals, containing higher iron and zinc levels than most commonly consumed grains (Obilana & Manyasa, 2002). Its phenolic constituents exhibit antioxidant, lipid-lowering, and anti-diabetic effects (Choudhary *et al.*, 2011; Saleh *et al.*, 2013).

Comparative studies show that while finger millet excels in mineral density, pearl millet frequently demonstrates higher extractive yields and greater phytochemical diversity. Physicochemical parameters including ash and extractive values strongly correlate with nutrient and bioactive content, making them essential tools for cultivar evaluation.

3. MATERIALS AND METHODS

3.1 Collection of Plant Material

Ten cultivars each of finger millet and pearl millet were procured from certified agricultural sources and authenticated by an agronomist. Cleaned grains were stored in airtight containers until analysis.

3.2 Preparation of Aqueous Extracts

Powdered samples (60 mesh) were macerated in distilled water for 24 h, filtered, and concentrated using a rotary evaporator. The dried extracts were weighed to calculate water-soluble extractive values following WHO (2011) guidelines.

3.3 Physicochemical Analysis

Standard methods from the Ayurvedic Pharmacopoeia of India (2001), Indian Pharmacopoeia (2018), and WHO Quality Control Methods (2011) were followed for determining: Loss on drying at 105 °C, Total ash, Acid-insoluble ash, Water-soluble ash, pH of 1% aqueous solution and Water-soluble extractive values. These analyses provide insight into purity, inorganic composition, and soluble phytochemical density.

4. RESULTS AND DISCUSSION

4.1 Finger Millet (*Eleusine coracana*)

4.1.1 Moisture Content (LOD)

LOD ranged from 10.44% (GPU-66, PRM-1) to 12.25% (RAU-8), all within acceptable limits for safe storage. Higher moisture in RAU-8 suggests slightly greater susceptibility to spoilage.

4.1.2 Ash Values

Total ash varied from 1.48% (Indaf-9) to 2.19% (RAU-8), indicating significant mineral variation. Acid-insoluble ash was consistently low (0.07–0.12%), confirming minimal contamination with earthy matter. Water-soluble ash was highest in RAU-8 (0.59%), implying a greater proportion of bioavailable minerals.

4.1.3 pH

pH ranged from slightly acidic (5.48) to near-neutral (7.50). Near-neutral cultivars (RAU-8, Indaf-9) may be more suitable for formulation due to improved stability.

4.1.4 Water-Soluble Extractives

Extractive values ranged from 6.34% (PRM-1) to 9.47% (RAU-8). Higher extractive yields in RAU-8, Indaf-9, and GPU-28 indicate higher levels of polar phytochemicals, including polyphenols and soluble fibers.

4.2 Pearl Millet (*Pennisetum glaucum*)

4.2.1 Moisture Content (LOD)

LOD values were low (8.92–10.47%), indicating good storage stability.

4.2.2 Ash Values

Pioneer 86M86 showed the highest total ash (2.76%), followed by ICMH-356 (2.67%). These cultivars are likely richer in minerals. Acid-insoluble ash remained minimal (0.22–0.34%). Water-soluble ash was highest in Pioneer 86M86 (0.93%).

4.2.3 pH

pH ranged between 4.89 and 7.27, suggesting variable suitability for food or nutraceutical formulations.

4.2.4 Water-Soluble Extractives

Pearl millet exhibited higher extractive yields overall, ranging from 10.47% (Local MP) to 15.70% (Pioneer 86M86). These high values indicate substantial phytochemical richness.

4.3 Comparative Interpretation

Finger millet demonstrated superior mineral density, notably in RAU-8 and Indaf-9, while pearl millet displayed significantly higher water-soluble extractives, especially in Pioneer 86M86 and ICMH-356. Pearl millet therefore offers greater value for extraction-based nutraceutical formulations, whereas finger millet provides mineral-rich functional food applications. Both millets exhibited acceptable purity, low contamination, and stable moisture levels.

5. CONCLUSION

This comparative study highlights notable physicochemical variability among cultivars of finger and pearl millet, emphasizing the importance of cultivar-specific selection for targeted applications. Finger millet cultivars RAU-8 and Indaf-9 demonstrated superior mineral composition and extractive values, whereas Pioneer 86M86 and ICMH-356 emerged as the most promising pearl millet cultivars, with the highest ash and extractive yields. These results reinforce the nutraceutical and functional food potential of both millets and support their use in developing health-promoting products.

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