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Comparative Mineral Composition Study of Indian Finger Millet (Eleusine Coracana L.) and Pearl Millet (Pennisetum Glaucum L.) Cultivars

Anubha Shukla[1], CBS Dangi[2]

[1,2]Department of Science, RKDF University, Bhopal

Abstract:
Evaluates and comparison of ten cultivars each of Indian finger millet (Eleusine coracana L.) and pearl millet (Pennisetum glaucum L.) mineral composition were performed in this study. Aqueous extracts were analyzed for essential macro and micro minerals including iron (Fe), calcium (Ca), magnesium (Mg), zinc (Zn), potassium (K), manganese (Mn), sodium (Na), and phosphorus (P). Results revealed that finger millet cultivars exhibited higher calcium and potassium content, while pearl millet cultivars were superior in iron, zinc, and magnesium. Among finger millet, RAU-8 contained the highest Fe (5.02 mg/100 g) and Ca (418.66 mg/100 g), whereas in pearl millet, Pioneer 86M86 recorded the highest Fe (8.86 mg/100 g), Ca (47.21 mg/100 g), and Mg (140.75 mg/100 g). The study emphasizes the potential of millet grains as a rich source of nutritionally significant minerals and supports their inclusion in functional food formulations to combat mineral deficiencies.

Keywords: Finger millet, Pearl millet, Mineral composition, Calcium, Iron, Nutritional assessment.

INTRODUCTION:

Millets are small-seeded cereals traditionally cultivated in semi-arid regions of India and Africa. They have gained renewed attention due to their rich nutritional profile, drought resistance, and potential health benefits. Among them, finger and pearl millet are major species with considerable dietary importance.

Finger millet has high calcium content (up to 10 times more than rice or wheat) and balanced amino acid profile. Pearl millet, on the other hand, is rich in iron, zinc, and other micronutrients, making it an important crop for addressing malnutrition and anemia (Shobana et al., 2013; Devi et al., 2014). Earlier studies have highlighted the bioavailability of minerals in millets depending on variety, soil type, and processing method (Obilana & Manyasa, 2002; Saleh et al., 2013). However, comparative data on different Indian cultivars under identical extraction and estimation conditions remain limited. This study aims to quantify and compare the mineral composition of selected Indian cultivars of finger millet and pearl millet to identify nutritionally superior genotypes.

Materials and Methods:

Sample Collection:

Ten cultivars each of pearl and figure millet were procured from regional agricultural research centers and other local farmer sources across India. Samples were cleaned, dried, and ground into fine powder

using a mixer blender.

Preparation of Extracts:

Aqueous extracts were prepared by soaking 10 g of powdered sample in 100 mL distilled water for 24 hours at room temperature, followed by filtration through Whatman No. 1 filter paper. Extracts were stored at 4 °C until analysis.

Mineral Estimation:

Mineral content (Fe, Ca, Mg, Zn, K, Mn, Na, P) was determined using standard wet digestion followed by Atomic Absorption Spectrophotometry (AAS) and Flame Photometry as per AOAC (2005) protocols. Results were expressed as mg per 100 g of dry weight.

Results and Discussion:

Mineral Profile of Finger Millet:

Finger millet cultivars exhibited considerable variation in mineral content (Table 1).

Table 1: Mineral content in Finger millet cultivars

Cultivar	Fe	Ca	Mg	Zn	K	Mn	Na	P
GPU 28	4.62	385.17	102.05	2.21	435.14	20.56	48.25	162.34
GPU 48	4.36	340.86	100.05	2.17	422.47	18.19	46.84	147.58
HR 911	3.95	353.37	86.48	1.99	378.38	20.16	47.77	151.72
PRM 1	3.82	323.67	100.05	1.94	359.62	18.52	43.47	141.17
Local (BH)	4.13	377.62	85.76	2.10	406.67	17.28	39.88	146.25
Indaf-9	4.24	393.03	106.30	2.35	406.67	18.52	40.89	160.73
RAU-8	5.02	418.66	108.56	2.43	462.91	22.35	50.26	157.61
PR-202	4.57	337.87	87.97	1.97	426.61	17.28	43.08	160.73
VL-315	2.72	323.67	90.31	2.03	368.76	18.04	41.24	148.94
GPU-66	3.88	313.15	85.04	2.05	414.42	16.72	38.60	138.75

The mineral analysis of the ten cultivars demonstrated significant genotypic variation in both macro- and micro-nutrient profiles. RAU-8 recorded the highest concentrations of Fe (5.02 mg/100g), K (462.91 mg/100g), Mn (22.35 mg/100g), Na (50.26 mg/100g), and an elevated P content (157.61 mg/100g), indicating its superior mineral density. GPU 28 showed comparatively high levels of Ca (385.17 mg/100g), Mg (102.05 mg/100g), K (435.14 mg/100g), and Mn (20.56 mg/100g), while Indaf-9 exhibited the maximum Mg content (106.30 mg/100g) along with high Ca (393.03 mg/100g) and P (160.73 mg/100g). Zinc levels remained relatively uniform across cultivars (1.94–2.43 mg/100g), with RAU-8 showing the highest value. In contrast, VL-315 had the lowest Fe concentration (2.72 mg/100g) and comparatively reduced macro-mineral levels. Overall, RAU-8, GPU 28, and Indaf-9 emerged as the most mineral-rich cultivars, whereas VL-315 and GPU-66 displayed lower mineral accumulation patterns.

Mineral Profile of Pearl Millet:

Pearl millet cultivars exhibited considerable variation in mineral content (Table 2).

Table 2: Mineral content in Pearl millet cultivars

Cultivar	Fe	Ca	Mg	Zn	K	Mn	Na	P
MPMH 21	8.15	45.32	135.12	3.19	305.27	1.25	10.8	295.16

Giant Bajra	7.28	41.58	132.47	3.16	282.66	1.20	10.38	268.33
Proagro No. 1	6.97	38.74	120.64	2.85	263.16	1.14	10.49	275.85
Local (BH)	7.41	40.46	111.67	2.73	285.30	1.21	9.73	256.66
Local (MP)	6.85	38.08	113.55	2.93	299.28	1.15	9.08	289.37
ICMH-356	7.34	42.36	118.53	2.87	267.78	1.12	9.47	292.24
Pioneer 86M86	8.86	47.21	140.75	3.43	299.28	1.24	11.49	301.18
MP-7792	7.15	39.75	115.49	2.80	265.45	1.10	10.69	278.45
MP-7872	7.21	38.41	113.55	2.95	260.91	1.11	9.56	270.79
Raj-171	6.85	44.43	111.67	2.73	250.22	1.05	9.31	256.66

The mineral composition of the ten cultivars showed marked variability across both macro- and micro-nutrient parameters. Pioneer 86M86 exhibited the highest concentrations of Fe (8.86 mg/100g), Ca (47.21 mg/100g), Mg (140.75 mg/100g), Zn (3.43 mg/100g), Na (11.49 mg/100g), and P (301.18 mg/100g), indicating its strong mineral enrichment capacity. MPMH 21 also demonstrated elevated levels of Fe (8.15 mg/100g), Mg (135.12 mg/100g), and P (295.16 mg/100g), followed closely by Giant Bajra with comparatively high Mg (132.47 mg/100g) and Fe (7.28 mg/100g) contents. In contrast, Raj-171 showed the lowest levels of Mn (1.05 mg/100g) and relatively reduced macro-mineral values, including K (250.22 mg/100g) and Ca (44.43 mg/100g). Zinc concentrations ranged between 2.73–3.43 mg/100g, with Pioneer 86M86 registering the maximum. Sodium levels remained low across cultivars, though Pioneer 86M86 and MPMH 21 recorded slightly higher values. Overall, Pioneer 86M86 and MPMH 21 emerged as the most mineral-dense cultivars, whereas Raj-171, MP-7872, and MP-7792 displayed comparatively lower mineral accumulation.

Comparative Analysis:

Finger Millet is unequivocally superior in its calcium content, containing up to ten times more than Pearl Millet. It is also a richer source of potassium and manganese. Conversely, Pearl Millet provides significantly more iron, phosphorus, magnesium, and zinc. This complementary nature means that incorporating both millets into a diet can help achieve a broader spectrum of micronutrient intake.

Conclusion:

This study provides a detailed comparative analysis of the mineral composition of ten Indian cultivars each of Finger Millet and Pearl Millet. The results conclusively demonstrate that Finger Millet is an outstanding source of calcium, while Pearl Millet is exceptionally rich in iron, phosphorus, and magnesium. The RAU-8 cultivar of Finger Millet and the Pioneer 86M86 cultivar of Pearl Millet were identified as being particularly nutrient-dense. Promoting the cultivation and consumption of these elite millet varieties can serve as a powerful, food-based strategy to improve nutritional security and combat

micronutrient deficiencies in vulnerable populations.

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