IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

COMPARATIVE NUTRITIONAL EVALUATION OF PEARL MILLET FLOUR: A STUDY ON MOISTURE, ASH, ALKALINITY, AND CALCIUM CONTENT ACROSS SELECTED COMMERCIAL BRANDS

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Abstract: This study evaluates and compares the nutritional properties of pearl millet flour (Bajra) from three commercial brands—Smita Grah Udhyog, Patanjali, and Manan. Parameters assessed include moisture content, total ash, water-soluble and insoluble ash, alkalinity of water-soluble ash, and calcium concentration. Smita Grah Udhyog samples recorded the highest total ash and calcium content, suggesting superior mineral density, while Patanjali showed better mineral bioavailability due to higher water-soluble ash. Natural indicator China rose was used to assess alkalinity. These findings provide insight into the nutritional quality of pearl millet flour, guiding consumer choices and contributing to food security.

Index Terms - Pearl millet flour, ash content, calcium, alkalinity, moisture, nutritional quality, commercial brands

INTRODUCTION

Pearl millet (Pennisetum glaucum), commonly known as Bajra, is a climate-resilient cereal grain rich in energy, protein, minerals (especially iron and calcium), and dietary fiber. Its cultivation is widespread in arid and semi-arid regions due to drought tolerance and high productivity in poor soils (Singh & Chauhan, 2019; Obilana & Manyasa, 2002). Given the rise in lifestyle-related disorders and nutrient deficiencies, millets like pearl millet are increasingly promoted as functional foods (Anitha et al., 2021; Devi et al., 2014). However, variations in the nutritional content among commercial brands necessitate scientific evaluation for informed dietary choices.

This study compares moisture, ash, alkalinity, and calcium levels in pearl millet flour from three commercial brands to assess nutritional quality and suitability for dietary supplementation.

RESEARCH METHODOLOGY

Population and Sample

1. To collect and analyze commercial samples of pearl millet flour.
2. To determine the moisture content, total ash, water-soluble ash, and acid-insoluble ash.
3. To assess the alkalinity of water-soluble ash using a natural indicator.
4. To estimate the calcium content in the flour samples.

Data and Sources of Data

Three commercially available brands—Smita Grah Udhyog, Patanjali, and Manan—were subjected to analysis based on standard procedures Moisture content was measured by oven drying 5 g of sample at 105°C to constant weight following AOAC (2019) guidelines.

1. Moisture Content: Oven drying of 2g samples at 105°C for 2 hours.
2. Total Ash: Incineration of 5g flour in silica crucibles at 550°C.
3. Water-Soluble & Insoluble Ash: Determined by boiling ash in distilled water, filtering, and weighing residues.
4. Acid-Insoluble Ash: Treatment with dilute HCl and weighing the residue.
5. Alkalinity of Water-Soluble Ash: Titration with N/10 H_2SO_4 using China rose extract as a natural acid-base indicator (Lee & McKinney, 2018; Johnson & Patel, 2017; Nair & Sriram, 2015).
6. Calcium Content: Oxalate precipitation method followed by titration with potassium permanganate at 80°C (Pearson, 1962).

RESULTS AND DISCUSSION

Minerals and ash contain of Pearl Millets flour (bajara) under investigation

Brand Name Pearl Millet flour	Sample	Moisture Content (g/100 g)	Ash (g/100 g)	Water insoluble Ash (g/100 g)	Water soluble Ash (g/100g)	Alkalinity of water Soluble Ash (meqn)	Calcium (mg/100 g)
Smita Grah Udyog	1	7.5	1.96	0.96	1	2.4	70.4
	2	4.5	2.5	0.92	1.58	2.4	88
	3	7	1.82	0.68	1.14	4.6	72
Patanjali brand	1	9	2.1	0.92	1.18	4.4	68
	2	8.5	1.8	0.66	1.14	6	84
	3	8	1.76	0.78	0.98	3	60
Manan brand	1	10	2	0.96	1.04	3	44.8
	2	10	1.74	0.8	0.94	1	32
	3	8	2.08	1.18	0.9	2	40

Theoretical framework

The variation in moisture, ash, and calcium levels among brands indicates differences in processing and raw material sourcing. Smita Grah Udhyog showed the highest calcium content and total ash, suggesting a denser mineral profile. High ash content correlates with better mineral richness (Saleh et al., 2013). Patanjali flour samples exhibited the highest water-soluble ash and alkalinity, indicating better mineral bioavailability—crucial for nutrient absorption (Krishnan & Meera, 2018; Kaushik et al., 2021). Manan had comparatively lower calcium values, potentially limiting its use for calcium-deficient individuals.

The use of China rose as a natural indicator provides an eco-friendly and educational approach to laboratory titrations (Johnson & Patel, 2017; Nair & Sriram, 2015).

Pearl millet flour demonstrates brand-dependent nutritional differences. Smita Grah Udhyog is better suited for calcium enrichment due to higher mineral density, while Patanjali is preferable for enhanced absorption due to higher bioavailability. Consumers and nutritionists must evaluate commercial flours beyond packaging labels to make informed choices, especially for therapeutic or supplemental use.

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