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Bajra: A Sustainable Nutricereal

Manish Tiwari, Shambhavi Singh, Komal Chauhan and Anupama Singh
National Institute of Food Technology Entrepreneurship and Management, Kundli, Sonipat, Haryana

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Introduction

A single meal can't provide us with all the vital nutrients and health benefits in an acceptable amount. It is necessary to consumea balanced diet consisting of all the vital macro- and micronutrients to replenish all of our nutritional requirements. Superfoods are food commodities that are perceived to be more nutrient-dense and favorable to health. The primary ingredients of the Indian diet are cereal grains like rice and wheat. All-wheat and all-rice based diets are deficient in sufficient amounts of many minerals, dietary fibres, and antioxidants.

About 820 million people worldwide face severe hunger. India has a global hunger index score of 29.1 in the 2022 and is positionedat 107th ranking out of 116 countries, indicating a towering level of hunger in the region (WHO, 2022).Therefore, the agricultural production system must make tough calls to mainstream the production of crops that are marginally grown in regions that have limited resources in order to overcome such a serious form of circumstance. Millets like bajra or pearl millet as shown in Figure 1also referred to as tiny millet, have the capability to assist the nation's most impoverished and vulnerable inhabitants, as well as to provide food and nutrition security, particularly in instances like COVID 19 pandemic. Millets also contribute in reducing the impacts of climate change because they have a lower carbon footprint than wheat and rice, which have carbon dioxide footprints of 3.968kg and 3.401kgper hectare, respectively(Pandey *et al.*, 2012).

Malnutrition, the worst non-communicable condition, is a major contributor to the emergence of chronic diseases. Due to inadequate nutritional intake of the recommended dietary allowances (RDA) level, malnutrition is substantially more prevalent amongst youngsters.The RDA is the bare minimum of nutrients required to preserve health. Pearl millet, a bountiful source of numerous micronutrients like iron, zinc, folic acid, and β-

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carotene, must be supplemented to the staple diets to combat malnutrition brought on by mineral deficiencies.

Cereal grains are considered a potent source of energy in human diet. Due to higher temperature tolerance and low maintenance cost with dense nutrient,pearl millet attracts the cultivators as well as researchers among all the cereal grain crops(Dube *et al*., 2021; Jukanti*et al*., 2016). Millets are classified into two categories as major millets which includes proso millet (*Panicum miliaceum*), foxtail millet (*Setaria italica*)and pearl millet (*Pennisetum glaucum*).

Among all the millets, pearl millet is the traditional crop and widely grown in Asian and African regions (Jukanti *et al*., 2016). Pearl millet can be grown under extreme climatic conditions and considered as the main fuel source for the large section of society existing in the semi-arid tropical regions of Asia and Africa (Basavaraj *et al*., 2010; Dube *et al*., 2021).

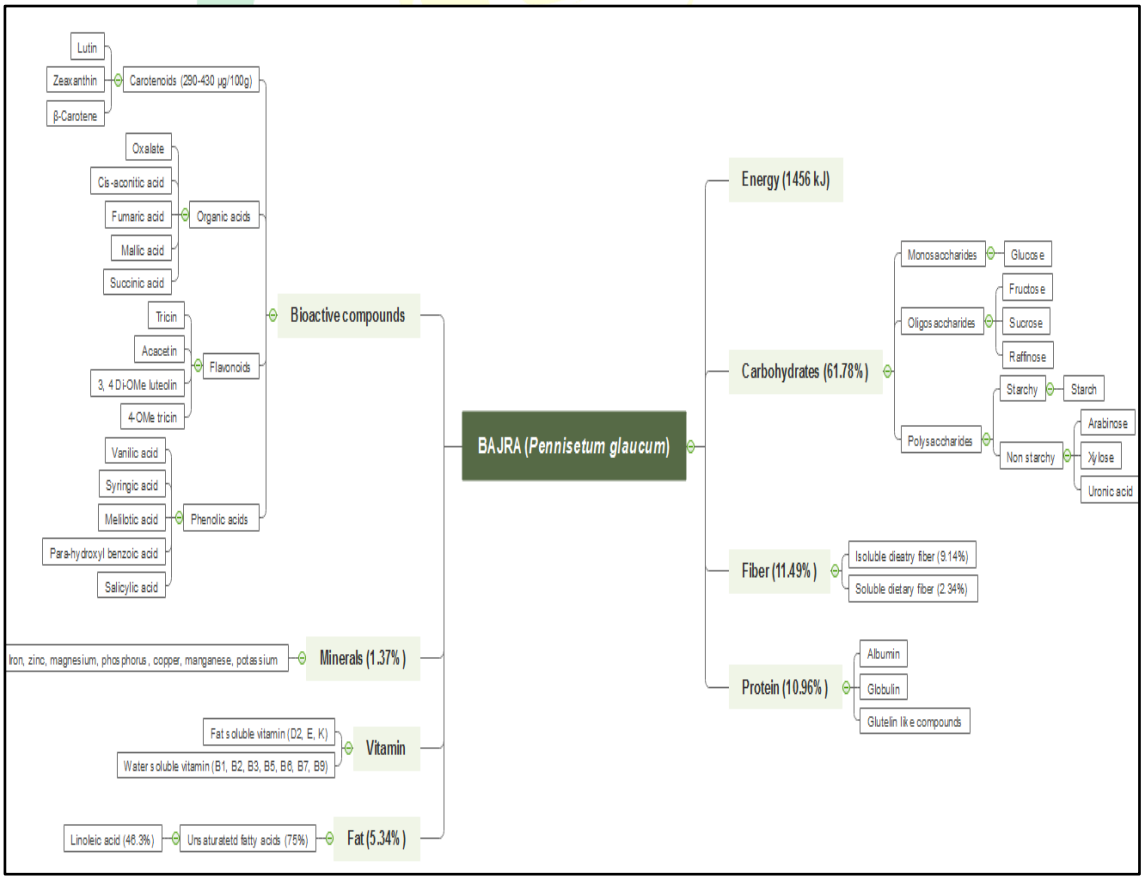

Figure 2: Overall nutritional and bioactive profile of bajra (*Pennisetum glaucum*)

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Nutritional and Bioactive composition

The grains of pearl millet have higher protein, fibers, and energy levels and thus are more nutritious than maize or sorghum (Hassan *et al*., 2021). In overall world millet production, India accounts about 41% of the production and thus serves as the largest millet programmer all over the world (FAOSTAT, 2020) and it contributed almost half of the percentile of the total millet production in India (Basavaraj *et al.,* 2010). Pearl millet is an important source of zinc and iron which provides a cost-effective solution for fighting against global hunger in terms of micronutrients (Krishnan and Meera, 2018; Pujar *et al*., 2020) as shown in Figure 2. Along with these, it contains ample number of bioactive components (Table 1) such as phenolics, phospholipids, flavonoids and linoleic acid (Chandrasekara and Shahidi, 2011a; Chandrasekara and Shahidi, 2011b; Chandrasekara and Shahidi, 2010; Chauhan *et al*., 2018) which raises the crop value and thus is called as nutri-cereal throughout the world (Akanbi *et al*., 2019).

Pearl millet is nutritionally equivalent to other well-liked cereals, and its kernel is high in phytochemical and phenolic matter, making it an important feed and food source. Moreover, they are natural free radical scavengers in food and biological systems, which have health advantages and will be credibly effective in opposition to a variety of etiological conditions (Shahidi and Chandrasekara, 2013).

Table 1: Bioactive compounds present in bajra (*Pennisetum glaucum*)

S. No	Bioactive Compounds	Health Benefits
1.	Phenolic compounds: Phenolic Acids, Flavonoids and Lignans(8.97-9.31 mg/100g)	• Hinder the development of several microorganisms, notably influenza and HIV. • Provides antioxidant, anti-obesity, anti-diabetic, anti-mutagenic, anti-carcenogenic, anti-microbial, and antiviral characteristics. • Phenolic abundant diets are associated with enhancing health and depress risk of incessant ailments like postprandial hyperglycaemia.

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2.	Phenolic acids: Gallic acid (7.3-13.6 mg/100g), catechin (0.3-23.2 mg/100g), ferulic acid (20.3-30.2 mg/100g), p-coumaric acid (0.6-1.3 mg/100g), trans cinnamic acid (486.3-731.2 mg/100g), hydroxybenzoic (253.5-436.7 mg/100g), quercitrin (0.3-2.4 mg/100g), quercetin (0.9-2.4 mg/100g), vanillic(48.3 mg/100g), caffeic (0.9-1.7 mg/100g).	• Great supplements as they impart protective diverse health effects. • Flavonoids, phenolic acids, and proanthocyanidins are examples of polyphenols with radical scavenging ability that hold significant interest and are anticipated to be advantageous in the reduction of many ailments.
3.	Carotenoid: Lutein, Zeaxanthin, β-Carotene (1.29-1.73µg/g).	• The primary incidence of blindness and vision impairment, age-related retinopathy, is known to be improved or even eliminated by lutein. • A potent antioxidant has been linked to an assortment of therapeutic benefits, besides a reduced incidence of age-related macular degeneration, glaucoma, and cataracts. • β-Carotene improve memory and cognitive function
4.	Phytosterols: Sitosterol, stigmasterol and campesterol.	• Phytosterols are effective in lowering cholesterol up to 14% while having no repercussions on HDL levels • Help reduce your risk of heart disease.

Initiatives

The Indian government and many states, like Karnataka and Odisha, have pioneered initiatives to increase millets' consumption and make it a popular food alternative. In order to

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disseminate "nutri-cereals" all over the nation, the Indian government declared 2018 the "National Year of Millets" and announced a millet campaign. The Integrated Child Development Services (ICDS) and MDM schemes across the nation will now incorporate millets as part of a trial programme recently set up by NITI Aayog(Malik, 2020).

In order to reduce carbon emissions from the use of fossil fuels, Hon'ble Prime Minister Shri Narendra Modi ji said in June 2021 that the target for attaining 20% ethanol blending with gasoline has been established for 2025. In India, maize and sugar molasses are used primarily for the manufacturing of bioethanol. A study among farmers in Madhya Pradesh, however, demonstrated that bio-ethanol may be generated using sorghum (jowar) and pearl millet (bajra), and that this fuel might reduce carbon emissions by approximately half.

Conclusions

Due to the abundance of important nutrients in sufficient quantities and of high quality, which are required for leading a healthy and nutrient-rich life, *bajra* or pearl millet is also renowned as the "*powerhouse of nutrition*." Elevated concentrations of micronutrients and macronutrients like iron, zinc, magnesium, calcium, phosphorus, copper, manganese, riboflavin, and folic acid can be discovered in pearl millet. It is becoming popular and preferred by people all across the world, especially in developed nations, as a consequence of its excellent nutritional properties.The significance of millets is apparent from its linkage to the food security, nutrition, and poverty eradication sustainable development goals (SDGs).Millets including pearl millet could be employed in interventions in India's sustainability practices. Technological breakthroughs in study have clarified millets' implications for energy optimization, climate resilience, and ecosystem restoration.

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