

## A Comprehensive Review On: Pennisetum Glaucum

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### ABSTRACT:

Pearl Millet (*Pennisetum glaucum*) is one of the oldest millets used by our ancestors. Along with wheat flour even bajra was included in the regular diet. It is known to have a very high fibre content which makes it healthier. It is used as a regular meal in places like Rajasthan, Gujarat. Now a day's it is gaining its importance back. Now bajra are recommended by many health professionals, Dieticians and Nutritionist because of its various health benefits. It is also not very expensive millet which can reduce its consumption. People are becoming more and more conscious about the fact of bajra having various good effects on the body. Pearl millet is useful not only as nutritional food but also it has many pharmacological activities.

**KEYWORDS:** pearl millet, *Pennisetum glaucum*, Poaceae, pharmacological activity.

### INTRODUCTION:

Pearl millet (*Pennisetum glaucum*) belongs to section Paniceae of family Poaceae. It is an important food and forage crop in Africa and Asia, and important forage in Americas. It has great potential because of its suitability to the extreme limits of agriculture. A total of 21,392 germplasm accessions including 750 accessions of wild species of genera *Pennisetum* and *Cenchrus*, assembled from 50 countries are conserved at International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) gene bank. Many of the wild relatives have evolved surviving drought, floods, extreme heat and cold, and in the process they have become adapted or developed resistance to the pests and diseases, which causes heavy losses to the crops. Considering the diversity and present-day distribution, Harlan (1971) and Harlan et al.

(1975) suggested a defused belt stretching from western Sudan to Senegal as the center of origin for pearl millet. Pearl millet is an important cereal crop as it is rich in nutrition with capability to grow at harsh climatic condition. A sudden climate changes and other natural disasters can create food security problem which raises the price of foods and also reduce the availability of food materials. In this condition pearl millet is an alternative nutritious crop for the poor men which provide enough nutrition for active and healthy life. It is cheap source of nutrition when compared to other major cereal crops. While having its nutrition and health benefits, utilization of this crop is restricted due to some anti-nutrition factors and poor keeping quality. Therefore, the aim of this review is to provide the information about nutritional profile, processing techniques, health benefits, products and problem of pearl millet in order to bring the great potential of this important small grain to producers and consumers.

Because of the higher content of nutrition value, pearl millet is notified as one of the millet under "Nutri-Cereals" by the Agriculture ministry, Government of India (GOI). Pearl millet is a good source of energy, protein, vitamins, dietary fibers and minerals. It is high in fat and better fat digestibility than other cereals. This is also high in unsaturated fatty acids with higher content of nutritionally important n-3 fatty acid. Among all the millets, pearl millet has highest content of macronutrients and significantly rich in resistant starch, soluble and insoluble dietary fibers (Antony et al. 1996; Ragaei et al., 2006). Pearl millet effectively helps in maintaining the blood sugar level constant in diabetes patient for long period of time (Dayakar Rao et al. 2017). Thus the nutritional composition and health benefits attracted today's market focused present health segment highlighting commercial viability of the crop.

Therefore the main objective of this article is to explore nutritional quality, health benefits, processing techniques, problems and product of pearl millet grain so as to use it for further research in the area of post harvest processing and value addition of pearl millet crop. Nutritional value of pearl millet Pearl millet has deep root system so it extract soil nutrient and holds higher nutritional value than the other cereal crops such as wheat, rice, maize and sorghum. Mineral-wise, this crop contain high amount of iron, zinc, magnesium, copper, manganese, potassium and phosphorus. It is good source of energy, with calorific value of 361 Kcal/100g and high in fiber content (1.2g / 100g) (Singh et al. 2018). Protein content in pearl millet is higher and it is also a good source of vitamin-B, Vitamin-A, folic acid, calcium and magnesium (Pattanashett et al. 2016). Pearl millet grain has high fat content than other cereal cause poor keeping quality of the product.



**FIGURE:1** Representing Parts Of *Pennisetum glaucum*

**INTRODUCTION PROFILE:** (4,5)

**SYNONYMS:**

*Pennisetum glaucum*, *Pennisetum Americanum*, bulrush millet, cattail millet, bajra.

**FAMILY:**

Poaceae. The genus *Pennisetum* contains about 140 species. The important wild relatives of cultivated pearl millet include: the progenitor, *P. glaucum* subsp. *Monodii*; *P. purpureum*; *P. pedicellatum*; *P. orientale*; *P. mezianum*; and *P. squarulosum*, etc.

**MORPHOLOGICAL CHARACTERISTICS:**

S.NO	CATEGORY	SUB-CATEGORY
1	Common name	Pearl Millet
2	Type	Annual grass
3	Family	Poaceae

4	Genes	Cenchrus
5	Species	C. americanus
6	Native range	Africa
7	Zone	2-11
8	Height	4-8 feet
9	Spread	10-15 cm
10	Bloom time	June/July to September/October
11	Bloom description	White or pearl in colour orsometimesyelloworbrown
12	Sun	Full sun to part shade
13	Water	Low
14	Maintenance	Medium
15	Suggested name	Flours, biscuits
16	Flower	Small but often showy clusters
17	Leaf	Linear or lance

Pearl millet [*Pennisetum glaucum* (L.)] is extensively cultivated for grain as well as fodder in the dry areas of north western and southern India. It is the fourth most important staple food crop after rice, wheat and sorghum primarily grown for grain and fodder production (Yadav et al., 2007). Pearl millet has an ability to grow in environments of low and erratic rainfall, high temperature and low soil fertility. Therefore, pearl millet is the main

source of food and fodder for the poor farming communities which are habitant to these environments. With its ability to adapt to diverse agroecological conditions, it occupies unique position in the world agriculture.

Pearl millet (*Pennisetum glaucum*) is an erect annual grass, reaching up to 3 m high with a profuse root system. Culms are slender, 1-3 cm wide. Leaves are alternate, simple, blade linear, pubescent and minutely serrated, up to 1.5 m long x

8 cm wide. The inflorescence is a panicle, 12 to 30 cm long. Fruits are grains whose shape differs

according to cultivars.

#### TRADITIONAL AND MEDICINAL USES: (6,7)

- The major part of the plant are used to treat multiple diseases.
- The leaves and stem are used as anti-hyperlipidemic activity, anti-oxidant activity.
- The fruit is good for diabetic diet, as it contains carbohydrates that are digested slowly and maintain stable glucose level.
- Beneficial for heart-rich in dietary fibres and lowering cholesterol properties of these grains are for heart patients.
- It is used in the prevention of constipation, gallstones
- It helps in reducing the colon cancer, treat celiac disease.
- It has an alkaline nature which fights acidity.
- It is very much helpful in bone growth development and repair.

#### PHARMACOLOGICAL ACTIVITIES

##### ANTI-OXIDANT ACTIVITY: (8)

A number of studies have been conducted around the world to demonstrate the effectiveness of plants used as medicines in possessing antioxidant properties that aid in the management/treatment of dangerous diseases. P. purpureum and Urooj investigated the antioxidant components and activities of pearl millet (*Pennisetum glaucum*) cultivars processed in various ways, including milling, boiling, pressure cooking, roasting, and germination. The cultivars revealed that the antioxidant activity of *P. glaucum* was influenced by the various ways in which the plant was processed, as well as the cultivars themselves. After being exposed to increasingly high temperatures, the flavonoid content of the plant reverses in the first result, indicating a high antioxidant activity of DPPH scavenging activity and RPA. When the plant extracts and the experimental methodology were compared, the results revealed a wide range of significant differences. Phytochemicals with antioxidant properties were found to be capable of inhibiting carcinogenesis. Furthermore, *in vitro* antioxidant activity of *P. purpureum* boiling-water extract was determined by 1,1-diphenyl-2-picrylhydrazyl and ferric reducing antioxidant power.

##### ANTI-DIABETIC ACTIVITY: (9)

*Pennisetum glaucum* (pearl millet) contains a variety of nutrients as well as non-nutrients such as phenols. It has high energy, high fiber, starch, is gluten free, and has a low glycemic index. *P. glaucum* supplementation has been shown in studies to reduce fasting blood glucose levels in rats induced with alloxan, and its impact has proven to have a higher potency power, even significantly more than the referenced drug glibenclamide. Furthermore, it was discovered that *P. glaucum* supplements reduced cholesterol levels in a dose-dependent manner and statistically significantly different when compared to the diabetic control group (diabetic untreated) than when compared to the standard drug standard drug, glibenclamide. Furthermore, *P. glaucum* supplementation at both 33 and 66% reduced serum triglyceride and LDL levels significantly ( $p < 0.05$ ). According to Brantley et al., who reported on the anti-diabetic activities of *P. purpureum* stem aqueous extract on alloxan-induced diabetes in rats. According to the report, fasting blood glucose was declining faster than the drug used as standard, metformin. Furthermore, the effects of *P. purpureum* (Achara) aqueous stem extract on the liver enzymes of albino rats induced with diabetes by alloxan were studied after three weeks of treatment.

##### ANTI-FUNGAL ACTIVITY: (10)

In the current study, majority of the endophytic strains of *Bacillus* species dwelling inside pearl millet host revealed their antifungal potentialities towards agriculturally three important plant pathogens which are *Rhizoctonia solani* (RS), *Sclerotium rolfsii* (SR), *Fusarium solani* (FS). These fungal pathogens are preferred as test organisms for antagonistic confrontation assay due to their wide host range, prolific growth, and ability to cause major economic loss in various crops. Further, in India, wilt and root rot caused by FS, is a major disease of pearl millet that significantly reduces production, and causes severe yield losses under congenial environmental conditions. So, microbial management of FS by utilizing endophytic *Bacillus* strains may offer a potential and viable solution to replace health hazardous and environment polluting chemicals. Endophytic *B. Amyloliquefaciens*, *B. subtilis*, and *B. cereus* strains with antifungal activity towards diverse types of crop pathogens have been well documented. The present investigation revealed that endophytic *B. amyloliquefaciens* (EPP35, EPP 42, EPP62, and EPP102), *B. subtilis* subsp.

subtilis (EPP65), and *B. cereus* (EPP5, EPP71, and EPP74) strains are highly promising and proficient antagonists showing  $\geq 50\%$  fungal mycelium growth inhibition against the tested phytopathogenic fungi (RS, SR, FS).

**ANTI-MICROBIAL ACTIVITY: (11)**

Preliminary test for presence of phytoconstituents and antimicrobial activities against *Escherichia coli*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Enterococcus* sp. and *Salmonella* sp. of hexane extract of three different cultivar of finger millet [*Eleusine coracana* (L.) Gaertn.] and pearl millet [*Pennisetum glaucum* (L.)] were performed. Observations revealed that the selected millets have good antimicrobial activities against the studied microorganisms. In both of these selected millets substantial amount of phytoconstituents like flavonoids, terpenoids, steroids, tannins and saponins was found. Due to antimicrobial properties and phenolic contents in millets are contributing to food safety and play a role in microbiological deterioration of food.

**ANTIHYPERLIPIDEMIC ACTIVITY: (12)**

Millet reduces VLDL cholesterol, a carrier of triacylglycerol in plasma, lowering triacylglycerol level even further. As a result, the consumption of millet grains may play an important role in lowering the level of blood lipids [30,31]. Many kinds of bioactive compounds, such as polyphenols, mostly flavonoids and phenolic acids, naturally occur in millet. Another important observation in the study is the ability of both the powder and ethanolic extract of MP to attenuate hepatic steatosis and associated hyperlipidemia in High Fat Diet induced rats.

**ANTIINFLAMMATORY, ADIPOSITY IN RATS WITH HIGH FRUCTOSE DIET: (13)**

Millet has shown antioxidant and anti-inflammatory effects as non germinated grain, once is a source of proteins, lipids, vitamins, minerals, and bioactive compounds, like phenolic acids,

flavonoids, gallic acid, syringic acid, p-coumaric and ferulic acid (Chandrasekara and Shahidi, 2012). However, millet contains the compound glycosyl flavones that can inhibit the thyroid enzyme peroxidase (TPO), responsible for the production of thyroid hormones, and also phytates that decrease the bioavailability of nutrients. In view of this, it is suggested that these grains be subjected to processing, such as germination, to reduce these compounds and enable safe consumption. Germination is a simple and inexpensive process in which hydrolytic enzymes promote biochemical changes, structural modification and synthesis of new compounds that can increase the nutritional value and stability of the grains. The present study demonstrated that germinated millet flour increased anti-inflammatory cytokine and reduced inflammatory markers, in addition to presenting antioxidant activity, and reduced adiposity and liver steatosis, thus minimizing the metabolic change induced by the HFHF diet in adult Wistar rats.

**BLOOD PRESSURE LOWERING EFFECT IN RATS: (14)**

The seeds of *Pennisetum glaucum* for its blood pressure lowering effect in rats. Aqueous-methanolic extract of *P. glaucum* seeds in 250, 500 and 1000 mg/kg doses was studied in normotensive, egg-fed diet and glucose-induced hypertensive rats using non-invasive technique. The extract significantly ( $p < 0.5 - p < 0.001$ ) decreased blood pressure and heart rate with maximum effect at 1,000 mg/kg dose. The extract was found to prevent rise in blood pressure of egg and glucose fed rats as compared to control group in 21 days study. The extract was safe in mice up to dose of 4g/kg and sub-chronic toxicity study showed that there was no significant alterations in blood chemistry of extract treated rats. It is conceivable, therefore, that aqueous-methanolic extract of *P. glaucum* seeds has exerted considerable antihypertensive activity which may be due to the presence of phytochemical constituents.

TABLE: 1 Earlier works done on *Pennisetum Glaucum* (8-14)

S.NO	AUTHOR NAME	ACTIVITY	JOURNAL NAME	YEAR	PARTS USED
1	Sumapushparaj et al.,	Antioxidant Activity	Multidisciplinary digital publishing institute	2014	Seeds

2	Brantley el al.,	Antidiabetic Activity	Bayero journal of pure and applied sciences	2016	Seeds
3	Prity Kushwaha et al.,	Antifungal Activity	Brazilian journal of Microbiology	2020	Seeds
4	Nadiyah S. et al.,	Anti Hyperlipidemic Activity	Nutrients 14 (9)	2022	Pearl Millet grain powder
5	Anubha Shukla et al.,	Antimicrobial Activity	Applied Research journal	2015	Seeds
6	Jaqueline Maciel Vieira et al.,	Anti-inflammatory Activity	Journal of Serial Sciences	2021	Seeds
7	Muhammad Naveed Mushtaq et al.,	Anti Hypertensive Activity	Bangladesh journal of Pharmacology	2015	Seeds

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