



International Journal of Home Science

ISSN: 2395-7476

IJHS 2024; 10(2): 167-171

© 2024 IJHS

www.homesciencejournal.com

Received: 05-08-2024

Accepted: 10-09-2024

Ayushi

Research Scholar, Dayalbagh
Educational Institute Agra,
Uttar Pradesh, India

Sonali Johri

Assistant Professor, Dayalbagh
Educational Institute Agra,
Uttar Pradesh, India

A review on the potential of pearl millets for diabetes mellitus

Ayushi and Sonali Johri

Abstract

Pearl millets (*Pennisetum glaucum*) are a highly nutritious cereal crop known for its resilience in dried and semi-dried regions. Pearl millets also known as Bajra. Pearl millet is one of the most important cereals. Pearl millet is a good source of energy, protein, vitamins, dietary fiber and minerals. It is high in fat better fat digestibility than other cereals. This is also high in unsaturated fatty acids. Pearl millet is good for human health and body. Pearl millet good for diabetic patients because it has a low glycemic index which can control blood sugar level. Its high dietary fiber slows down digestion and absorption of carbohydrates, which further helps in regulating blood sugar levels. Pearl millet is a good source of antioxidant. It is suitable for managing diabetes. Pearl millet uses for make different products for Indian and other cultures. Pearl millet is also used for other diseases like heart diseases; cancer cholesterol and tumors. Therefore the current review addresses the role of pearl millet in managing diabetes.

Keywords: Pearl millet Diabetes mellitus Nutritive value Health benefits

Introduction

Pearl Millets

Pearl millet (*Pennisetum glaucum*), also known as Bajra, is one of the four most important cereals (rice, maize, sorghum and millets) grown in marginal agricultural areas where annual rainfall is variable, unpredictable and very low (200–500 mm) and where daily temperature 30°C. Pearl millet is a nutritional cereal grown on about 10 million hectares in India, as well as India is one of the largest producers of pearl millet crop in the world. Pearl millet is primarily grown in Africa, India, and parts of Asia. Pearl millet is an annual grass that can grow between 1.5 to 4 meters in height. It has deep roots, allowing it to thrive in dry environments with poor soil conditions. The grains are small, round and vary in color from white to yellow, gray, brown, and even purple. Pearl millet grains are typically around 3-4 mm in diameter. It is an important staple crop in arid and semi-arid regions where other cereals may not survive due to extreme heat, low rainfall, and poor soil fertility. India is the largest producer of pearl millet, particularly in states like Rajasthan, Gujarat, Maharashtra and Uttar Pradesh. Pearl millet is highly valuable in semi-arid regions because of high productivity under heat and drought conditions. It has deep roots, allowing it to thrive in dry environments with poor soil conditions. It is an important staple crop in arid and semi-arid regions where other cereals may not survive due to extreme heat, low rainfall, and poor soil fertility. Pearl millets are very nutritional as compared to other cereals protein, energy, vitamin and mineral are high in pearl millets. Many health professionals recommended pearl millet due to provide good benefits for body health. Pearl millet is a good source of iron and zinc and can be effectively put to use in the manufacture of nutrient rich foods to face micronutrient deficiencies. However, the anti-nutrients present in it could interfere with the availability of these nutrients to the body. Pearl millet is a good source of energy, protein, vitamins, dietary fiber and minerals. It is high in fat better fat digestibility than other cereals. This is also high in unsaturated fatty acids and other contents. Pearl millet is good for human health and body (FAO, 2012).

Nutritive Value

Pearl millet is rich in essential nutrients, making it an important food for addressing nutritional deficiencies. Some key nutritional components include:

1. **Carbohydrates:** Provides a good source of energy, but with a lower glycemic index compared to refined grains.

Corresponding Author:

Ayushi

Research Scholar, Dayalbagh
Educational Institute Agra,
Uttar Pradesh, India

2. **Protein:** Contains around 10-12% protein, with a balanced amino acid profile.
3. **Fiber:** High in dietary fiber, which supports digestion and helps manage cholesterol and blood sugar levels.
4. **Minerals:** It is a rich source of iron, phosphorus, magnesium, and zinc, which are essential for various bodily functions.
5. **Vitamins:** Contains B vitamins, including niacin, thiamine, and riboflavin, that are crucial for metabolic processes.
6. **Antioxidants:** Contains polyphenols and flavonoids that have antioxidant properties.

Table 1: Nutritional value of pearl millets 100/gm

Nutrients	Pearl millet
Moisture	12.4g
Protein	11.6-11.8g
Fat/lipids	4.8-5.0g
Minerals	2.2-2.3 mg
Dietary fibre	11.3g
Carbohydrates	9.0g
Phosphorus	296mg
Potassium	307mg
Magnesium	137mg
Calcium	42mg
Sodium	10.9mg
Zinc	3.1mg
Iron	8.0mg

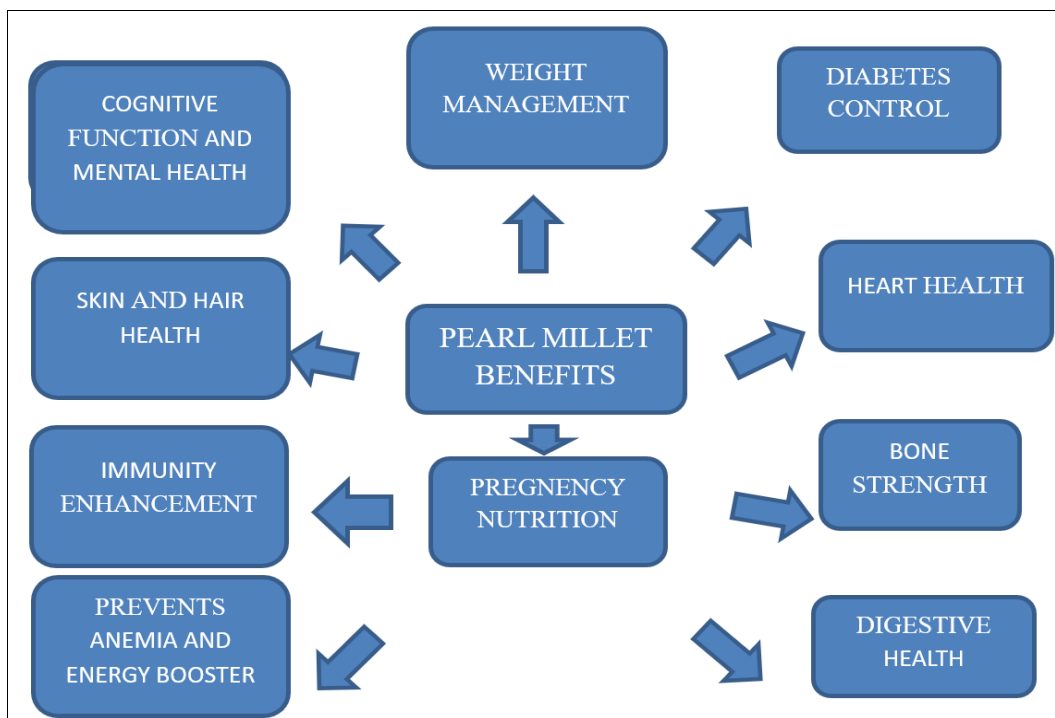


Fig 1: Benefits of pearl millets

Table 2: Health benefits in pearl millets

Disease	Health benefits in pearl millets
Anemia	Pearl millet is a great way to prevent iron deficiency anemia. High iron content (8mg/100g), High Zinc content (3.1mg/100g).
Constipation	Pearl millet helps in constipation, High fiber (1.2/ 100gm).
Diabetes	Pearl millet increase insulin sensitivity and reduce triglyceride levels in the body. Has low glycemic index help in dealing with diabetes.
Cancer	Nutritional content have anti-inflammatory and antioxidants properties that is important for preventing cancer and tumor growth.
Help in bone growth development and repair	Pearl millet has a large amount of phosphorus and good source of calcium for bone growth and development.
Stomach Ulcer	Pearl millet is one of the very few foods that remains alkaline property thus prevents formation of stomach ulcers.
Heart health	Pearl millet also helps reduce the bad cholesterol levels of the body. This reduces the risk of heart disease and maintains good heart health.
Weight loss(obesity)	Pearl millet helpful in the process of weight loss as it high fibre content.
Well digested source of nutrients	Compared to other cereals, pearl millet has a better apparent small intestine digestibility of critical amino acids. Due to its high content of essential amino acids and its exceptional in vitro pepsin digestibility scores, pearl millet appears to be a highly digestible and nutrient-dense source of protein and calories for humans.
Preventing gall stones	It's also known that pearl millet's high fiber content lowers the chance of gallstone development. Pearl millet's insoluble fiber content reduces body's overproduction of bile.
Respiratory problem for asthma patients	Pearl millet includes a high concentration of magnesium, which helps asthma patients lower the intensity of their respiratory difficulties and is also useful in preventing migraine attacks.
Anti -allergic properties	Pearl millet contains numerous health benefits. The grain is very digestible and has a low risk of triggering allergic responses. Because of its hypoallergenic properties, it is safe to include in the meals of infants, breastfeeding mothers, the elderly, and convalescents.

Products of pearl millets

Pearl millets are used to produce various different -different conventional foods.

- 1. Traditional Uses:** In India and Africa, pearl millet is used to prepare traditional flatbread, porridge and fermented beverages . In Rajasthan for example it is used to make bajra roti.
- 2. Modern Uses:** Pearl millet is increasingly being used in multigrain flours, breakfast cereals, baked goods and

snack foods. It’s Versatility in being combined with other grains like wheat, rice, and oats makes it a valuable addition to various food formulations.

- 3. Nutri Pre Mixes:** Pearl millet is commonly used in fortified flour blends, especially in the presentation of nutri pre mixes like the it’s working on. It enhances the nutritional profile of the blend by adding minerals, fibres and protein.



Bajra roti



Bajra laddu



Bajra cake



Bajra ban

Role in Nutri pre mix

Due to its high nutritional profile, pearl millet can be a key ingredient in the formulation of nutritionally enhanced pre-mixes. It contributes to the fiber, iron, and overall nutrient

density of such products, particularly when combined with other ingredients like oats and besan, making it suitable for health-conscious individuals, diabetics, and people looking for gluten-free alternatives.

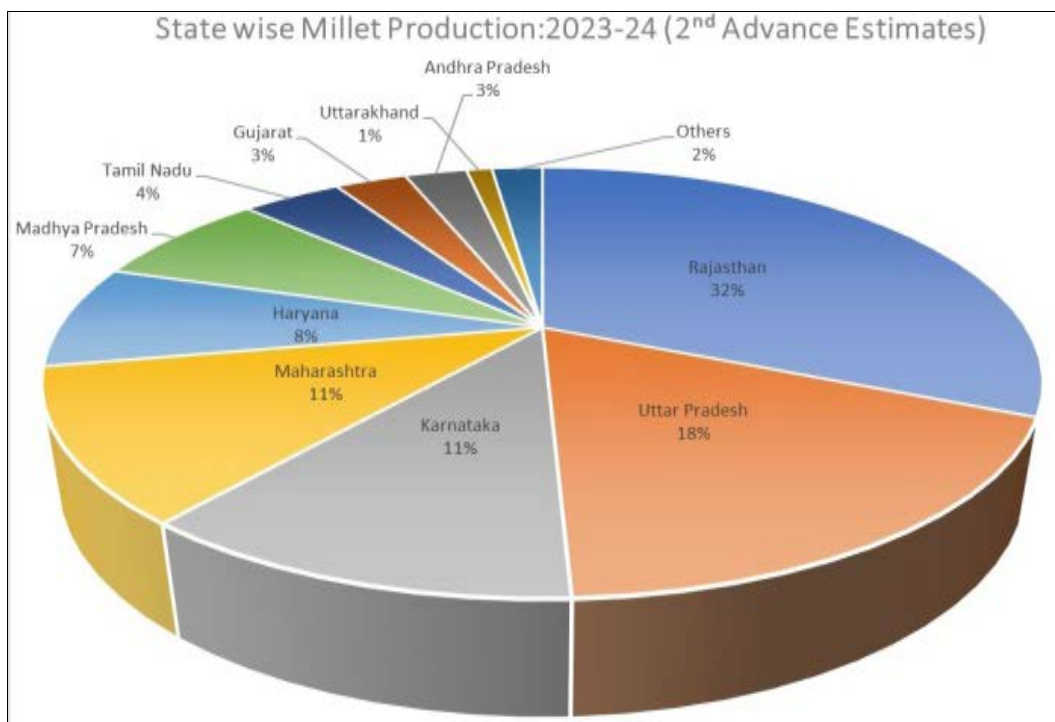


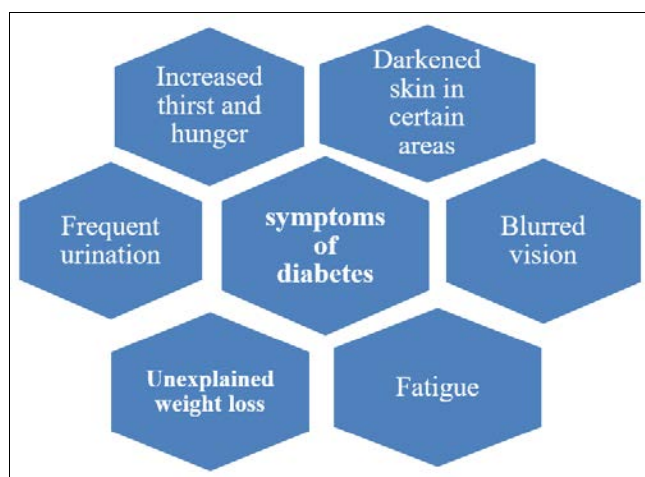
Fig 2: State wise pearl millet production percentage

Diabetes mellitus

Diabetes is a chronic medical condition that occurs when the

body either doesn’t produce enough insulin or can’t effectively use the insulin it does produce. Insulin is a

hormone produced by the pancreas that helps regulate blood sugar (glucose) levels. When insulin function is impaired; glucose builds up in the blood instead of being used for energy by the cells, leading to high blood sugar levels (hyperglycemia). Diabetes mellitus is a metabolic disorder characterized by high blood glucose levels due to a decreased ability or complete inability of the tissues to utilize carbohydrates, accompanied by changes in the metabolism of diminished effectiveness of the hormone insulin, produced by the beta cells of the islets of Langerhans of pancreas. The metabolic derangement in long standing cases is frequently associated with permanent and irreversible, functional and structural changes in the vascular system of the body characteristically affecting the eye, kidney and nervous system. Diabetes, usually referred to as diabetes mellitus, is a collection of metabolic illnesses marked by persistently high blood sugar (hyperglycemia). Diabetes is expected to increase from 2.8% (in 2000) to 4.4% (in 2030) worldwide. It is possible to anticipate that by 2030, there would be over 366 million cases of diabetes worldwide. It is often known that following a meal, a diabetic patient's blood glucose level increases dramatically above normal.



Types of diabetes

- Type 1 Diabetes:** An autoimmune condition where the immune system attacks and destroys the insulin-producing cells in the pancreas. People with Type 1 diabetes need to take insulin every day to survive. It is usually diagnosed in children or young adults, though it can occur at any age.
- Type 2 Diabetes:** Occurs when the body becomes resistant to insulin or when the pancreas doesn't produce enough insulin. It is the most common form of diabetes, often associated with lifestyle factors like obesity, poor diet, and physical inactivity, though genetics also play a role. Can be managed with lifestyle changes (diet, exercise), oral medications, and sometimes insulin.
- Gestational Diabetes:** Develops during pregnancy and typically goes away after childbirth. Increases the risk of developing Type 2 diabetes later in life for both the mother and child.

Antioxidant value of pearl millets

Pearl millet (*Pennisetum glaucum*) is known for its antioxidant properties, which play a beneficial role in managing diabetes. Its high content of phenolic compounds, flavonoids, and tannins contributes to its antioxidant capacity. Here's how the antioxidant quality of pearl millet can be linked to diabetes management:

- Phenolic Compounds:** Pearl millet contains phenolic acids such as ferulic acid, which have strong antioxidant properties. These compounds help neutralize free radicals, reducing oxidative stress—a condition often elevated in diabetics. By reducing oxidative stress, pearl millet may help mitigate complications associated with diabetes, such as cardiovascular disease.
- Flavonoids and Tannins:** These bioactive compounds have been shown to improve glucose metabolism by inhibiting enzymes involved in carbohydrate breakdown. This can lead to a slower release of glucose into the bloodstream, preventing spikes in blood sugar levels. The antioxidant effect of flavonoids also protects pancreatic β -cells, which are responsible for insulin production.
- High Fiber Content:** The fiber in pearl millet not only aids digestion but also contributes to a low glycemic index (GI), helping maintain steady blood sugar levels. The presence of antioxidants further enhances the fiber's ability to reduce inflammation and oxidative damage in diabetic patients.
- Reduction of Advanced Glycation End Products (AGEs):** The antioxidant properties of pearl millet can inhibit the formation of AGEs, which are compounds formed when proteins or fats combine with sugar in the bloodstream. AGEs are known to exacerbate diabetic complications by increasing oxidative stress and inflammation.

Pearl millet for diabetes control

A grain crop that is extensively grown, pearl millet (*Pennisetum glaucum*) has drawn interest recently due to its possible role in the treatment of diabetes mellitus. Elevated blood sugar levels are a hallmark of diabetes mellitus, a chronic metabolic disease that is typically managed with dietary and lifestyle changes. Because of its distinct nutritional makeup, pearl millet has been studied for potential benefits in the treatment of diabetes.

pearl millet's possible advantages for people with diabetes is provided below: **Reduced Glycemic Index (GI):** Eating pearl millet lowers blood sugar levels gradually because it has a low glycemic index. Because they help regulate blood sugar levels and reduce abrupt spikes and crashes, foods with a low GI are beneficial for people with diabetes. **Abundant in Microfiber Diet:** Especially soluble fiber, pearl millet is an excellent source of dietary fiber. Fiber is essential for blood sugar regulation because it increases insulin sensitivity and slows down glucose absorption. People with diabetes can better control their blood sugar levels by consuming pearl millet. Pearl millet-eating populations have lower rates of diabetes. Pearl millet is an efficient way to treat diabetes. It releases glucose into the blood more slowly and digests more slowly than other foods because of its high fiber content. This makes a big difference in helping diabetes individuals maintain stable blood sugar levels over time. Another benefit of pearl millets is that they can help lessen the symptoms and indicators of diabetes. Higher amounts of leucine and other nutrients that are favorably connected to a nutritious diet for diabetes are known to be present in them. Similar to pearl millet flour mostly contains maltose and D-ribose, with minor quantities of fructose and glucose. Diet is seen to be the most important component of diabetes therapy, particularly for non-insulin independent diabetes mellitus (NIDDM), where lipid and protein metabolism are the secondary abnormalities and glucose metabolism is the primary malady. For diabetics, millet is a good nutritional option because of several of its

benefits. Studies verify this. For instance, increasing millet protein can increase insulin sensitivity, lower blood sugar and lipid levels, and test various diets on diabetic.

1. **Low Glycemic Index:** Pearl millet has a GI of around 54, meaning it causes a slower and more stable rise in blood glucose levels compared to high-GI foods like rice or wheat. This helps in managing blood sugar spikes.
2. **Rich in Fiber:** Its high dietary fiber slows down digestion and absorption of carbohydrates, which further helps in regulating blood sugar levels.
3. **Magnesium Content:** Pearl millet is a good source of magnesium, a mineral that is important for enhancing insulin sensitivity, thereby reducing the risk of insulin resistance, a common problem in Type 2 diabetes.
4. **Resistant Starch:** It contains resistant starch; a type of carbohydrate that behaves like fiber and doesn't raise blood sugar levels as quickly, contributing to better glycemic control.
5. **Rich in Nutrients:** Apart from fiber, pearl millet contains several essential nutrients like iron, protein, and vitamins, making it a nutritious option for those managing diabetes.
6. **Magnesium:** It is a good source of magnesium, which plays a role in regulating insulin secretion and improving insulin sensitivity.
7. **Complex Carbohydrates:** The slow-digesting complex carbohydrates in pearl millet help maintain steady blood sugar levels.
8. **Phytochemicals:** Pearl millet contains polyphenols and antioxidants that may help manage blood glucose levels.

Conclusion

Pearl millet, also known as bajra, has been shown to be beneficial in managing diabetes due to its low glycemic index (GI), which helps regulate blood sugar levels. The high fiber content in pearl millet slows down the digestion process, resulting in a gradual release of glucose into the bloodstream. Additionally, it is rich in magnesium; a mineral that plays a crucial role in increasing insulin sensitivity and improving glucose metabolism. Consuming pearl millet regularly can reduce postprandial blood sugar spikes, making it a suitable grain for diabetic patients. Its nutrient profile, including essential vitamins, minerals, and antioxidants, also supports overall health, contributing to a balanced diet for individuals with diabetes. Incorporating pearl millet into the diet can be an effective dietary intervention for blood glucose control and diabetes management, while also offering additional health benefits.

References

1. <https://journaljsrr.com/index.php/JSRR/article/view/1914/3772> 23 feb, 2024
2. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9322144/> 18 July, 2022
3. Patni D, Agrawal M. Wonder millet - pearl: Nutrient composition and potential health benefits – A review. Department of Home Science, University of Rajasthan, Jaipur.
4. Deepika, Varma K. Pearl Millet: The real pearl for diabetes. University of Rajasthan, Jaipur; c2023.
5. Pei J, Umopathy VR, Vengadassalopathy S, Hussain SFJ, Rajagopal P, Jayaraman S, Veeranghavan VP, Palaisamy CP, Gopinath K. A review of the potential consequences of pearl millet. 8 c2022.
6. Rani S, Singh R, Sehrawat R, Kaur BP, Upadhyay A. Pearl

- Millet: A review. National Institute of Food Technology Entrepreneurship and Management, Kundli, India; c2017.
7. Sangma SJ, Janakisrinath P, Vidhya, Patra D, Kumar S, Magrey AH, Senthil Kumar T, Sanjeeth J. Review of the prospective significance and recommendations of Pearl Millet (*Pennisetum glaucum*) for diabetes mellitus; c2023.
 8. Satyavathi CT, Ambawat S, Khandelwal V, Srivastava RK. Pearl Millet: A climate-resilient nutraceutical for mitigating hidden hunger and providing nutritional security. Indian Council of Agricultural Research – All India Coordinated Research Project on Pearl Millet, Jodhpur, India; Department of Molecular Breeding (Genomics Trait Discovery), International Crops Research Institute for Semi-Arid Tropics, Patancheru, India; c2021.
 9. Pearl millet processing: A review. Available from: https://www.researchgate.net/publication/322278079_Pearl_millet_processing_a_review#:~:text=Findings%20From%20the%20literature%20reviewed,as%20well%20as%20rancidity%20problems (January 2018).
 10. Satankar M, Patil AK, Kautkar S, Kumar U. Pearl Millet: A fundamental review on underutilized source of nutrition; c2020.
 11. <https://www.beatoapp.com/blog/health-benefits-of-pearl-millet/> June 2024.
 12. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10560538/#:~:text=Millet%20help%20in%20the%20management, triglyceride%20levels%20in%20the%20body.&text=Millet%20are%20the%20cereals%20of,easily%20mixed%20into%20a%20diet> September 2023.
 13. Sangma SJ, Janakisrinath P, Vidhya C, Patra D, Kumar S, Magrey AH, Senthil Kumar T, Sanjeeth J. Review of the prospective significance and recommendations of Pearl Millet (*Pennisetum glaucum*) for diabetes mellitus; c2023. Available from: https://ijariie.com/AdminUploadPdf/PEARL_MILLET_THE_REAL_PEARL_FOR_DIABETES_ijariie20838.pdf (July 2022).
 14. Rani S, Singh R, Sehrawat R, Kaur BP, Upadhyay A. Pearl millet processing: a review; c2018.
 15. Hussan ZM, Sebola NA, Mabelebele M. The nutritional use of millet grain for food and feed: a review; c2021.
 16. Sujith S, Sahoo S, Dheeraj C, Hemanth MS, Saha S, Sarkar A, Niharika N. Millet a nutri-cereal: Nutritional value, health benefits and value addition in dairy products; c2023.