

# Millet: A Promising Nutri-Cereal for Combating Food Security

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Millet is known for its nutritional value, versatility in cooking, and its ability to grow in harsh environments with poor soil conditions (Admassu *et al.*, 2009). Pearl millet, finger millet, foxtail millet, kodo millet, barnyard millet and small millet species are among the various varieties of millet. Each type of millet has its own unique characteristics and uses. India having a total share of about 40.62 % and 10.91 million tonnes estimated production, dominates the global production of millets (Ashoka *et al.*, 2020). Finger millet contributes to about 12 % of the total millet cultivation area which covers more than 25 countries of Asia and Africa and are distributed in about 10 genera and 20 species (Lupien, 1990). In India, finger millet ranks sixth in crop production after maize, rice, wheat, bajra and sorghum (Amadou *et al.*, 2013). It is used for preparation of products like idli (Indian fermented steamed cake), dosa (Indian fermented pan cake), porridges, roti (unleavened flat bread) and beverages (Malathi and Nirmalakumari, 2007). Finger millet is usually considered as a low-cost millet that contains more dietary fiber, a number of phytonutrients, and several minerals, with almost no complaints of negative effects.

## Nutrient composition of millet

Millet is known for its highly nutritious compositions as shown in table 1. All varieties of millets have good amount of protein, minerals and dietary fibers. Finger millet and pearl millet are known to have higher dietary fibers (11.5 % and 11.3 %, respectively) as compared to brown rice and polished rice (Malleshi *et al.*, 1986). In general, millets have lower lysine contents than legumes and animal proteins. It has numerous important amino acids boosting its importance for the consumer (Subrahmanyam *et al.*, 1955). Compared to all other grains, millet contains good amount of calcium as well as phosphorus, iron and numerous other trace elements and vitamins (Gopalan *et al.*, 2009). Due to its

high calcium and iron content, it is usually regarded as a healthy supplement for kids and teenagers to support bone health and hemoglobin. Millet is also known to be rich in various phytonutrients / phytochemicals containing several phenolic compounds such as ferulic acid, catechins, and vanillic acid and carotenoids such as lutein and zeaxanthin, which act as antioxidants and have potential health benefits (Shobana *et al.*, 2009). It is a good source of phytosterols, including sitosterol, campesterol, and stigmasterol and are known to have flavanoids like quercetin and kaempferol (Subba Rao and Muralikrishna, 2002).

## Health benefits of millet

Millet is a nutritious grain that provides several health benefits. Brief overview of the health benefits associated with consuming millet is highlighted below:

- **Nutrient-Rich:** Millet is rich in various essential nutrients, including dietary fiber, protein, magnesium, phosphorus, and B vitamins such as niacin and thiamine. It is also gluten-free, making it suitable for individuals with gluten intolerance or celiac disease (Gopalan *et al.*, 2009).
- **Heart Health:** Millet contains compounds such as fiber, antioxidants, and magnesium that support heart health. The fiber content helps in reducing cholesterol levels, while magnesium helps regulate blood pressure. These factors contribute to a lower risk of cardiovascular diseases (Chandrasekara and Shahidi, 2011).
- **Blood Sugar Regulation:** The complex carbohydrates and fiber in millet are digested slowly, leading to a gradual release of glucose into the bloodstream. This slow digestion helps regulate blood sugar levels and can be beneficial for individuals with diabetes or

those at risk of developing the condition Shobana *et al.*, (2010).

- **Digestive Health:** Millet being a wonderful source of dietary fibre aids in promoting a healthy digestive system and warding off constipation. Consuming adequate fibre may lower the incidence of gastrointestinal illnesses and promote a healthy gut flora (Tovey *et al.*, 1975).
- **Weight Management:** The high fiber and protein content in millet contribute to a feeling of fullness and can help control appetite. Including millet in your diet may support weight management goals by reducing overeating and snacking between meals (Backes *et al.*, 2008).
- **Antioxidant Properties:** Millet contains various antioxidants, including phenolic compounds and flavonoids, which help neutralize harmful free radicals in the body. These antioxidants offer protective benefits against chronic diseases and help maintain overall health (Veenashri and Muralikrishna, 2011).
- **Celiac-Friendly Alternative:** Millet is naturally gluten-free, making it a suitable grain choice for individuals with celiac disease or gluten sensitivity. It can be used as a gluten-free substitute in various recipes, providing a nutritious alternative to gluten-containing grains.

#### Value addition of millet

Millet, being a versatile grain, can be used to create various value-added products. There are several ways to use millet as a substitute for other cereal grains and their flour, including rice and other starchy grains. Various millet based value-added products are mentioned below:

- **Millet Flour:** Millet grains can be ground into flour, which serves as a gluten-free alternative to wheat flour. Millet flour can be used in baking bread, muffins, pancakes, cookies, and other baked goods.
- **Millet-based Ready-to-Eat Meals:** Millet can be incorporated into ready-to-eat meals like

millet pilaf, millet-based risotto, or millet-based salads. These products can be a convenient and nutritious option for individuals looking for quick and healthy meal solutions.

- **Millet Breakfast Cereals:** Millet grains can be processed into breakfast cereals like millet flakes, puffed millet, or millet-based granola. These cereals can be consumed with milk or yogurt, or added as a topping to smoothie bowls or desserts.
- **Millet Snacks:** Millet can be used to create a wide range of snacks such as millet-based crackers, chips, and puffed snacks. These snacks can be flavored with various seasonings and spices.
- **Millet-based Beverages:** Millet grains can be used to make nutritious beverages like millet milk, millet-based smoothies, and millet-based energy drinks. These beverages can be enjoyed as a refreshing and healthy alternative to traditional drinks.
- **Millet-based Baby Food:** Millet can be processed into baby food formulations, providing a nutrient-rich and easily digestible option for infants and young children.
- **Mandua roti/chapatti/Papad:** In comparison to other cereal-grain rotis, ragi rotis and papad are essentially darker in colour. Not only can millet fortification enhance the flavour of chapatti/papad, but it also helps diabetes patients regulate their blood sugar levels.
- **Noodles/Mandua pasta:** Noodles made from millet are a fantastic choice for anyone trying to increase their intake of whole grains as well as for people who are following certain dietary restrictions. Compared to wheat noodles, they have a distinct texture and flavour profile that adds variation to the meals while still being a good source of critical nutrients.
- **Extruded products:** Extrusion technology is a good way of transforming ingredients into value added products. Millet flour can be used to make gluten-free pasta and noodles, providing a healthier option for individuals

with gluten intolerance or those looking for alternative grain-based options

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- **Millet-based Fermented Products:** Fermented foods like dosa, idli, and dhokla are highly well-liked in India since they are typically consumed as light breakfast and evening snacks. Millet grains can be used in the fermentation process to create products like millet-based sourdough bread, fermented millet porridge (such as idli and dosa), and millet-based alcoholic beverages (Karki al., 2020, Shobana et al., 2013).

## Conclusions

Millet stands as a nutritional powerhouse with its impressive array of essential nutrients and health benefits. Its role as a versatile and nutrient-rich staple has been recognized across cultures and time, contributing to global food security and wellbeing. Millet's remarkable nutritional profile, including its high content of fiber, vitamins, minerals and antioxidants, positions it as a valuable component of a balanced diet, promoting overall health and wellness. Beyond its nutritional attributes, Millet has also been associated with medicinal properties that have been embraced by traditional medicine systems. Its potential to contribute to heart health, diabetes management, and digestive well-being underscores its significance as a functional food with far-reaching health implications. Looking ahead, Millet's future scope appears promising on multiple fronts. As society places greater emphasis on sustainable agriculture and climate-resilient crops, Millet's inherent ability to thrive in diverse agroecological conditions positions it as a key player in ensuring food security in a changing world. Moreover, ongoing research into Millet's bioactive compounds and health benefits holds the potential for further exploration of its medicinal properties, potentially leading to the development of nutraceutical products. In the context of a global shift towards healthier and more

sustainable diets, Millet is poised to play an increasingly important role as a source of nourishment, well-being, and ecological resilience. As consumers continue to seek nutritious and environmentally conscious food options, Millet's rich nutritional content, versatile applications, and potential health-promoting qualities position it as a steadfast contender in shaping the future of food and nutrition.

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**Table 1 Nutrient composition of different millets (per 100 g of edible portion)**

Parameter	Ragi/finger millet	Proso millet	Foxtail millet	Little millet	Kodo mille	Barnyard millet	Pearl millet
<b>Proximate</b>							
Moisture (g)	13.1	11.9	11.2	11.5	12.8	11.9	12.4
Protein (g)	7.3	12.5	12.3	7.7	8.3	6.2	11.6
Fat (g)	1.3	1.1	4.3	4.7	1.4	2.2	5.0
Minerals (g)	2.7	1.9	3.3	1.5	2.6	4.4	2.3
Dietary fiber (g)	11.5		2.4	2.53	2.47	1.98	11.3
Carbohydrates (g)	72.0	70.4	60.9	67	65.9	65.5	67.5
Energy (kcal)	328	341	331	341	309	307	361
<b>Vitamins</b>							
Carotene (µg)	42	0	32	0	0	0	132
Thiamine (µg)	0.42	0.20	0.59	0.30	0.30	0.33	0.33
Riboflavin (µg)	0.19	0.18	0.11	0.09	0.09	0.10	0.25
Niacin (µg)	1.1	2.3	3.2	3.2	2.0	4.2	2.3
Source: Karki <i>et al.</i> , 2020; Admassu <i>et al.</i> , 2009; Gopalan <i>et al.</i> , 2009; SubbaRao and Muralikrishna, 2002							

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