

Millets: A Potential Source of Energy and Nutrients for Health a Comprehensive Review

Abstract

Millets, cereals, and grains are crucial for supplying enough nutrients and have also been demonstrated to have positive impacts on disorders of lifestyle. There is no need to find newer sources of energy and other natural and nutritional material with the desirable functional characteristics, as the public's understanding of nutrition and health care research substantiates the potential of phytochemicals, such as polyphenols and dietary fibers, on their health beneficial properties. For those in low-income groups, it is an important staple food crop in India. Because of its high level of calcium (0.38%), dietary fiber (18%), and phenolic compounds (0.03%–3%), its usefulness in terms of nutrition is well understood.

Keywords: Millets, Energy sources, Nutritional value, Health importance

Introduction

The term “Millets” (A Nutritional Crop) is applied to various grass crops whose seeds are harvested for human food or animal feed (Thapliyal *et al.*, 2015). Millet is most important cereal after rice, sorghum and wheat and it is a most staple food for thousands of years in many parts of Africa and India. Millions of people around the world particularly those who live in hot, humid climates, rely heavily on millets as a food source. Because they can thrive in challenging environmental conditions like little rainfall, millets are a staple meal in many developing nations. For millions of people living in dry areas, millet serves as their primary source of protein and energy. It has been reported that millet has many nutritious and medical functions (Obilana and Manyasa, 2002; Yang *et al.*, 2012).

Millets are highly nutritious but vastly ignored as a main source of food primarily due to lack of awareness. However, increasing research on millets showing beneficial effects on health, they have gained significant importance in the field of biomedical research (Rao *et al.*, 2011).

Millets are minuscule, round in shape and their high nutrient content is contributed by carbohydrates (60-70%), proteins (7-11%), crude fiber (2-7%) and fat (1.5-5%). Besides, millets

are gluten free and are rich in vitamin B, iron, calcium, potassium, zinc and magnesium. (Majid *et al.*, 2019).

The year 2023 is declared the “**International Year of Millets**” by the UN, following India’s proposal. India has earlier observed the year 2018 as the “National Year of Millets”. The declarations aim to raise awareness of millets' role in food security and nutrition as well as to scale up their quality and sustainable production.

Millets are generally of seven types with different colors, shapes, sizes, and cultivation areas. These grains are the oldest, and probably the first cereal grain, known to human for domestic use; they are small-seeded, round shape cereals and belong to the Poaceae family (FAO, 2020). Millet is the sixth-highest yielding grain in the world. India is the largest producer and second largest exporter of millets in the world. According to the data from the US Department of Agriculture’s Foreign Agricultural Service, as of February 2023, India produced 39% of the millets worldwide for the year 2022.

Table 1 :Types of Millets:

Millets	Common Name	Scientific Name
Finger Millets	Ragi	<i>Eleusinecoracana</i>
Foxtail Millets	<i>Kangni</i>	<i>Setariaitalica</i>
Sorghum Millets	<i>Jowar</i>	<i>Sorghum bicolor</i>
Pearl Millets	<i>Bajra</i>	<i>Pennisetumglaucum</i>
Proso Millets	<i>Chena</i>	<i>Panicummiliaceum</i>
Kodo Millets	<i>Kodon</i>	<i>Paspalumscrobiculatum</i>
Barnyard Millets	<i>Sanwa</i>	<i>Echinochloacrugalli</i>
Little Millets	<i>Kutki</i>	<i>Panicumsumatrense</i>

Table 2 Millets and its Nutritional Composition: (mg/100 g)

Millets	Protein	Fat	Fibre	Minerals	Carbohydrates	References
Finger Millets	7.3	1.3	11.5	2.7	72.05	Himanshu <i>et al.</i> 2018.
Foxtail Millets	11.2	4.0	6.7	3.3	63.2	Jaybhaye <i>et al.</i> 2014.
Sorghum Millets	10.4	3.1	2.0	1.68	70.7	Tiwari <i>et al.</i> 2023

Pearl Millets	11.8	4.8	2.3	2.2	67.0	Saini <i>et al.</i> 2021.
Proso Millets	11.0	3.5	8.5	1.9	56.1	Das <i>et al.</i> 2019.
Kodo Millets	8.35	1.5	5.2	3.3	65.6	Bunkaret <i>et al.</i> 2021.
Barnyard Millets	10.5	3.6	12.6	2.0	68.8	Ugare <i>et al.</i> 2011.
Little Millets	8.92	2.5	6.39	1.72	65.5	Rao <i>et al.</i> 2017.

Finger Millets

Finger millets, also known as ragi, are an important staple meal for persons in poor socioeconomic groups and those with metabolic diseases including diabetes and obesity. Finger Millet is considered as a good nutritious food which can be replaced in place of rice or wheat. They are a good source of carbohydrates, protein, dietary and minerals (Mathanghi and Sudha 2012). It is important because of its excellent storage properties and nutritive value (Shashi *et al.*, 2007).

With its rich fibre content, it is a good laxative and helps to prevent constipation. Finger millet is a good for infants, elderly and pregnant women due to its high calcium content. It is also very good for lactating women as it helps in producing sufficient breast milk (Ambati and Sucharitha 2019).

Foxtail Millets

Foxtail millet is a widely farmed and consumed cereal that is significant to the global economy, particularly in India, China, and other regions of Asia, North Africa, and the Americas. It is a cereal grain that belongs to the *Setaria* genus of the *Poaceae* family and subfamily *Panicoideae* (Sharma and Niranjana, 2018). Foxtail millet is gluten free, rich in protein and low in carbs which helps in the formation of neurotransmitter acetylcholine that transfers messages between muscle and nerves. Being a powerhouse in nutrition, Foxtail millet keeps up the stamina, keeps you stronger and builds immunity in order to fight various infections lurking around.

Sorghum Millets

In terms of cultivated land area and worldwide production, sorghum is one of the most important grains. Sorghum is also a gluten-free grain that is high in nutrients and physiologically active chemicals. Sorghum is the fifth most significant cereal crop in the world, capable of growing in a wide range of climates and widely cultivated as a grain, sweet, forage, low-lignin,

and biomass crop. It is a drought and heat-tolerant crop that may be grown in arid environments (Ratnavathi and Komala, 2016). Sorghum contains iron, calcium fiber, protein and wax policosanols which help to reducing cholesterol level and other health benefits (O.S.K. Reddy 2017).Sorghum has anticarcinogenic properties and antimutagenic property due to presence of tannins and polyphenoals (Awika and Rooney 2004).

Pearl Millets

Pearl millet is a resistant cereal crop compared to wheat and rice, is cultivated in places with deficient rainfall. It is the sixth most important grain in the world and it is the principal source of food in Asia and Africa's semiarid regions (Upadhyaya *et al.*, 2016).Pearl millet which accounts for 40% of global output (Yang *et al.*, 2012).More than 95 percent of pearl millets are grown in developing countries, with India leading the way with 9.8 million hectares of total world production (Rani *et al.*, 2017).Pearl millet may be easily stored at low temperatures and moisture levels due to its high oil content (4-9%). Unsaturated fatty acids, folate, copper, zinc, iron, magnesium, calcium, vitamin B complex, and other nutrients are also present in significant amounts. (Saini *et al.*, 2021).

Proso Millets

Proso millet certainly is a climate-smart, gluten-free, ancient, and small grain cereal, which is healthy to humans and the environment. Proso millet consists of protein and Vitamin. Traditionally it is used as recuperative food, especially post pregnancy or illness (Jana Kalinova, 2007).Proso millet is beneficial in preventing Pellagra condition, which is caused due to the niacin Vitamin B₃. Proso millet has high content of Niacin. Pellagra is a skin disease which causes the skin to become dry, scaly and rough (Prathyusha *et al.*, 2021).When ingested as food for people, proso millet offers numerous advantages. Proso millet is a promising rotational crop for dry land farming systems based on winter wheat since it has several distinctive qualities (such as drought tolerance and a short growing season). When employed in a two-year wheat/summer fallow cropping system, proso millet offers the most cost-effective production system (Das *et al.*, 2019).

Kodo Millets

India is known as the country where Kodo millet was originated. It is assumed that domestication of Kodo millet was took place about 3000 years ago (Arendt and Dal, 2011).Kodo millet is a traditional food that aids in weight loss and has a taste that is similar to rice. It is

quickly absorbed and rich in phytochemicals and antioxidants, which aid in preventing many ailments linked to a sedentary lifestyle (Ambati and Sucharitha 2019). Postmenopausal women with signs of cardiovascular illness, such as high blood pressure and excessive cholesterol, can benefit greatly from regular use of Kodo millet. It contains more antioxidants, which protect against oxidative stress and keep type 2 diabetes patients' glucose levels stable. Asthma, migraines, high blood pressure, heart attacks, atherosclerosis, and diabetic heart disease can all be treated with Kodo millet (Bunkar *et al.*, 2021).

Barnyard Millets

The ancient millet crop known as barnyard millet (*Echinochloa* species) is farmed around the world in warm, temperate climates. It is very popular in Asia, particularly in India, China, Japan, and Korea (Madhusudhana *et al.*, 2018). It is the fourth most produced minor millet and provides many hungry people with food security all around the world (Renganathan *et al.*, 2020). The majority of barnyard millet is grown for human consumption, though it is also fed to animals. Two of the most often used varieties of barnyard millet are *Echinochloa frumentacea* (Indian barnyard millet) and *Echinochloa esculenta* (Japanese barnyard millet), which are both cultivated and wild species (Sood *et al.*, 2015). Barnyard millet is a short duration crop that can grow in adverse environmental conditions with almost no input and can withstand various biotic and abiotic stresses.

Little Millets

Little millet is one of the significant minor cereals that is widely cultivated in the tropics and a staple food for some global low-income populations is little millet. In addition to providing minerals and vitamins, little millet is a comparable supply of protein, fat, carbs, and crude fibre to other cereals like rice and wheat. Additionally, it contains phytochemicals such as tannins, phytate, phenolic acids, and flavonoids (Pradeepet *et al.*, 2011). Even though it is small, little millet is not less nutritious than other grains. It contains a lot of minerals, including calcium, iron, zinc, and potassium, as well as good amounts of B vitamins. The kind of necessary fats that aid in weight loss are also provided to the body by this. Another advantage is that it has a high fibre content, which makes it a perfect substitute for rice in Pongal or even Kheer. (O.S.K.Reddy, 2017).

Different Types of Millets:



Fig.1 Sources: Tiwari *et al.*, 2023

Health Benefits of Millets:

Millets contain a wide range of nutritional benefits that can help to prevent a variety of health issues, such as lowering blood pressure, reducing the risk of heart disease, preventing cancer and cardiovascular disorders, and reducing the incidence of tumours among others. Other health advantages include lengthening the time it takes for the stomach to empty and giving the intestines some roughage (Sarita *et al.*, 2016). Millet is an alkaline forming food. Alkaline based diet is often recommended to achieve optimal health, meaning when it combines with digestive enzymes. The soothing alkaline nature of millet helps to maintain a healthy pH balance in the body, crucial to prevent illnesses (Vishakha *et al.*, 2016). Millets are rich in minerals and phytic content, are a staple diet in many African and Asian countries. Millet has the lowest agricultural

production cost of any grain (Hasan *et al.*, 2021). Saleh *et al.*, (2013) worked on millet grains – processing, nutritional quality and its potential health benefits. Processed food enhances bioavailability of micronutrients. Findings of the study revealed that they contain many health promoting components and are highly nutritious.

Usually postmenopausal women suffer from signs of cardiovascular disease, like high cholesterol levels, high blood pressure. Hence, consumption of Kodo millet in their daily diet is extremely beneficial to maintain good health (Chandrasekara, and Shahidi 2010).

Millet's high protein content promotes healthy kid growth and development. The calcium content of millet aids in bone formation and reduces the chance of bone fractures. It also contains high-quality iron, which aids in the treatment of anemia. The gluten-free characteristic of millet aids celiac disease patients and hence aids in gluten insensitivity. (Prathyusha *et al.*, 2021).

In fact, millets have numerous nutritional benefits and should be included in our daily diet; however, the majority of well-informed individuals have never heard of millets or the nutritional benefits of millet. Because of fiber-free foods, the entire world is suffering severe health concerns. Based on previous research studies, it is very clear that all lifestyle diseases can be eliminated simply by instilling the habit of consuming millets in their regular diet and thus avoiding refined foods such as rice, wheat, processed meats, refined flours, refined oils, and ready-to-eat foods. (Prathyusha *et al.*, 2021). Millets showed results that they are rich phenolic acids, phytates and tannins which are the antinutrients which help in reducing the risk for colon and breast cancer. It is showed that phenolics in millets are effective in preventing the cancer initiation and progression *in vitro* (Ambati *et al.*, 2019).

Millets have ability to reducing glucose by enzymatic hydrolysis of complex carbohydrate in hyperglycemia. The aldose reductase enzyme helps in preventing accumulation of sorbitol and decrease the risk of diabetes (Mishra *et al.*, 2021).

Millets are good source of magnesium which helps in reducing heart attack. Millets are rich in phyto-chemicals which help in lowering cholesterol and prevent cardio vascular disease (Sarita and Singh 2016).

Conclusion:

In modern times, consumers are easily attracted to bakery and fast foods, resulting in a number of health issues. Thus, the current study aimed to highlight the importance of healthy food and to incorporate millets into their normal diet as a healthy - nutritious food. Millets have multiple health benefits to include these ancient prized grains-like seed in our regular diet. Most of

the civilized people have not even heard about millets and much less understand the benefits of millet nutrition. And yet, millet is one of the best-kept secrets of our ancient ancestors. As a result, it can be stated that individuals must be aware of millets and their health benefits, as well as use millets to live a healthy and happy life.

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