THE ROLE OF MILLETS NUTRITION IN HUMAN HEALTH: A SYSTEMATIC REVIEW

Janhavi R. Ukkalgaonkar[1]
Assistant professor
Shardabai Pawar Mahila Arts, Commerce and Science College, Shardanagar, Baramati, Pune,
Email Id - janhaviukk4199@gmail.com

Sai. V. Deshpande[2]
Assistant Professor and HOD, Department of Food Science and Nutrition
Shardabai Pawar Mahila Arts, Commerce and Science College, Shardanagar, Baramati, Pune,

Monika M. Bhosale[3]
Assistant professor
Shardabai Pawar Mahila Arts, Commerce and Science College, Shardanagar, Baramati, Pune,

Shivani A. Patil[4]
Assistant professor
Shardabai Pawar Mahila Arts, Commerce and Science College, Shardanagar, Baramati, Pune,

---

Abstract :

The term "superfoods" refers to natural, nutrient-rich foods that offer balanced amounts of macro and micronutrients, along with significant levels of polyphenols, phytonutrients, and other minor components that promote health and well-being. While superfoods may vary based on geographical location, certain ones, which are commonly available worldwide. This review aims to evaluate the nutritional profiles of various millets and compare them with widely accepted superfoods. The result revealed that most millets are highly nutritious and can be classified as superfoods. Millets contain substantial amounts of antioxidants and bioactive compounds that support cardiovascular health and other diseases. Additionally, millets offer non-nutritional benefits, such as they require minimal water and are cost-effective to cultivate, making them a highly accessible food source. Traditionally referred to as the "poor men's food grain" due to its affordability, millets were widely consumed. However, with the advent of the Green Revolution in the 1960s to mid-2000s, the demand for millets drastically declined, almost leading to their extinction.

In recent years, there has been a resurgence of interest in millets, and they are now recognized as the "new superfood." Millets are making a comeback due to their numerous health benefits and suitability in combating chronic diseases such as diabetes and obesity. This renewed focus on millets reflects a shift towards embracing sustainable and nutritious food options.

(Key words:** superfoods, geographical location, millets, highly nutritious, cardiovascular health, Green Revolution, new superfood, chronic diseases**).

Introduction :

Millets hold significant importance in the cereal production landscape, securing the 6th position globally. These hard, small-seeded grasses thrive well in arid zones where soil water content and moisture levels are limited. Approximately 55-59% of the total global millet production occurs in African countries, primarily due to their presence in dry zone areas. South Asian countries, including China and India, are substantial contributors as well, collectively standing as the second largest producers of millets on a global scale (Subramanian V, 1981). Indeed, millets stand as significant cereal grains alongside major staples like wheat, rice, and maize. They play a crucial role as primary food sources for millions of individuals, particularly those residing in hot and dry regions across the globe (Adekunle, 2012). Millets play a crucial role in the diets of many underdeveloped countries due to their resilience in adverse weather conditions, particularly limited rainfall. In Africa, millet stands as a primary source of energy and protein for millions of individuals. Various studies have highlighted the nutritious and medicinal attributes of millet (Obilana and Manyasa, 2002; Yang et al., 2012). Its drought-resistant nature and ability to be stored for extended periods without succumbing to insect damage (Adekunle, 2012) make it an essential food during times of famine, emphasizing its importance in ensuring food security.

Millets, often referred to as minor cereals, are a crucial source of energy for populations residing in arid and semi-arid regions worldwide, particularly in Africa and Asia. They are predominantly grown in marginal lands with challenging agricultural conditions, where major cereals struggle to yield substantial harvests (A. A. Adekunle, 2012; Amadou. I, 2013). Belonging to the grass subfamily Panicoideae, millets owe their popularity and utilization in these regions to their drought resistance and extended shelf life compared to major cereals like corn, wheat, and rice (Adekunle, 2012). Consequently, they have emerged as vital sources of energy and essential nutrients, primarily carbohydrates and protein, in regions prone to low rainfall.

Despite the advantages of cultivating millets, their production rates globally have not kept pace with other cereal crops. The total harvested area for millets worldwide decreased from 36.2 million hectares in 2010 to 31.4 million hectares in 2014, marking a 15% decline. During the same period (2010-2014), the cultivation area for maize (corn) and wheat increased by 11.3% and 2%, respectively (FAOSTAT).

In recent years, there has been a heightened emphasis on 'superfoods,' denoting nutrient-rich, natural, dense, and balanced foods that provide abundant antioxidants and bioavailable compounds. These foods are believed to contribute to improved health by regulating cholesterol, blood pressure, and preventing certain cancers and cardiovascular diseases (Ekesa B. N, 2017). Although the term is often used in marketing, consumers view superfoods as products bridging the gap between food and medicine, many of which are exotic or come from indigenous cuisines (Ekesa B. N, 2017; . Loyer J, 2016).

Millets indeed hold a unique position in agricultural biodiversity and contribute

significantly to the food security systems of impoverished farmers, especially in regions like Sub-Saharan Africa. Pearl millet, a crucial millet variety, is a staple food in the Sahel region, with India being its largest producer (Bhattacharjee et al., 2007). Millets are commonly ground into flour, rolled into large balls, parboiled, and consumed as porridge with milk. Additionally, millets are prepared as beverages. Roti, made from pearl millet, has been a primary food for farmers in Gujarat, India (FAO, 2009). As the global population grows, there's an increasing need to explore locally grown and consumed plants like millets to address food security, particularly in low-income households in regions such as India and the Sahel zone (Obiana, 2003).

Cereals, especially millet-based foods and beverages, have a global presence and continue to be fundamental components of the diet in numerous African countries (Obilana and Manyasa, 2002; Amadou et al., 2011). This review aims to encapsulate the nutritional composition of millets, elucidate their health benefits, and shed light on their use within the food industry.

Classification of millets :

There are many varieties of millets that are in turn classified into major and minor millets based on the importance of their production.

Major millets		Minor millets
1. Finger millet 2. Proso millet 3. Pearl millet 4. Foxtail millet 5. Sorghum		1. Adlay millet (Job's tears) 2. Polish millet (Fonio) 3. Indian barnyard millet 4. Japanese barnyard millet 5. Little millet 6. Kodo millet 7. Browntop millet

List of all varieties of available millet (Source: Vanga, S 2018)

Finger Millet :

Finger Millet, known for its high nutritional value, stands out among cereals due to its natural calcium content, beneficial for bone strength and fracture prevention. Additionally, it is a rich source of natural iron, aiding in preventing Anemia. This versatile grain can be a great alternative to rice or wheat, offering a nutrient-packed option abundant in proteins, amino acids, minerals, and vitamins. Its high fibre content acts as a natural laxative, promoting digestive health by preventing constipation.

Especially beneficial for infants, the elderly, and pregnant women due to its calcium richness, Finger Millet supports the production of breast milk in lactating women. Moreover,

it proves advantageous in various health conditions such as high blood pressure, heart issues, asthma, and diabetes by aiding in slow digestion and glucose release. Notably, it contributes to boosting hemoglobin levels, combating malnutrition, and addressing degenerative diseases (O.S.K.Reddy, 2017).

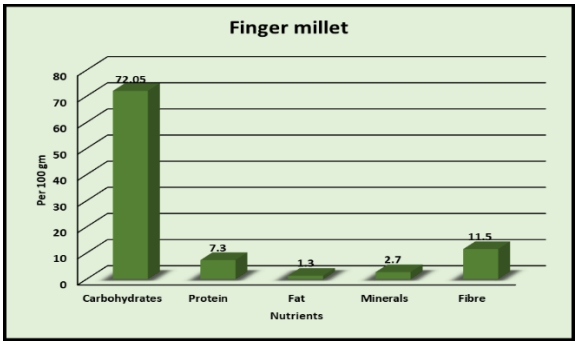
Finger millet	
Botanical name	Eleusine coracana (L.) Gaertn.
Vernacular name	Ragi, Mandua,Nagli, Kapai, Marua, Nachni, African bird's foot, rapoko, Hunsa, wimbi, bulo, telebun, koracan, kurakkan
Origin place	East African highlands
Characteristics	Moderately resistant to heat, drought and humidity, adapted to wide altitude range (Up to 2100 m amsl), rich source of calcium.

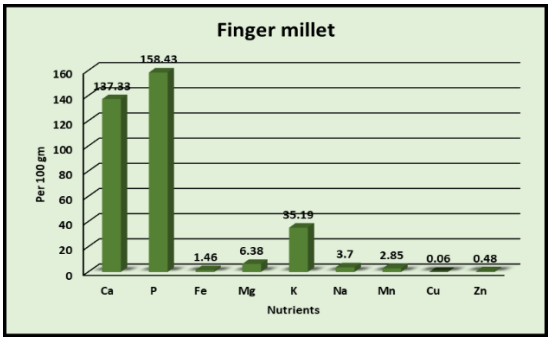
Finger millet	
Carbohydrates	72.05
Protein	7.3
Fat	1.3
Minerals	2.7
Fibre	11.5

(Shobana et al., 2013)

Finger millet			
Ca	137.33	**Na**	3.70
P	158.43	**Mn**	2.85
Fe	1.46	**Cu**	0.06
Mg	6.38	**Zn**	0.48
K	35.19		

(Sanusi et al., 2019)





Barn yard millet :

In warm, temperate regions globally, the ancient crop barnyard millet (Echinochloa

species) is cultivated. It holds immense popularity in Asia, particularly in countries like India, China, Japan, and Korea (Madhusudhana R, 2017). As the fourth most widely cultivated minor millet, it plays a crucial role in ensuring food security for numerous underprivileged individuals worldwide (Renganathan VG, 2020). Although it's utilized as animal feed, barnyard millet predominantly serves as a staple for human consumption. Notable variations include Indian barnyard millet and Japanese barnyard millet, both cultivated and found in the wild, representing some of the most favored types (Sood S, 2015). Barnyard millet, being a short-lived crop, exhibits resilience to various biotic and abiotic stresses, allowing growth even in adverse environmental conditions with minimal resources.

Barnyard Millet stands out for its low carbohydrate content, making it easily digestible. The grains of this millet boast superior nutritional quality, particularly in terms of amino acid composition compared to other crop grains. Consuming barnyard millet can aid in reducing blood glucose and lipid levels, making it beneficial for individuals with diabetes. Moreover, it serves as a suitable food option for those intolerant to gluten content (O.S.K. Reddy, 2017).

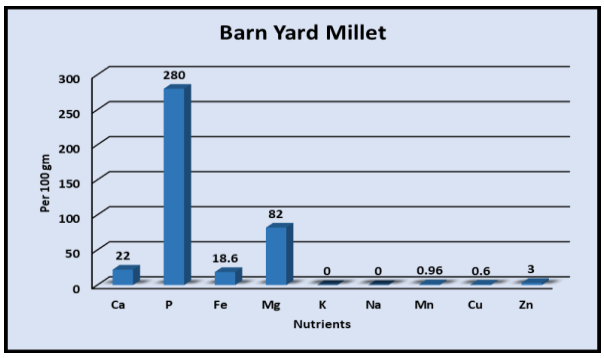
Barn yard millet	
Botanical name	Echinochloa crus-galli (L.) P. Beauv. (syn. E. esculenta (A. Braun)
Vernacular name	Japanese, Jhingora, Kudraivali, Oodalu, sanwa, sawan, Korean, kweichou
Origin place	Japan
Characteristics	Very short duration (Fastest growing), voluminous fodder, not limited by moisture, high altitude adapted (Up to 2700 m amsl)

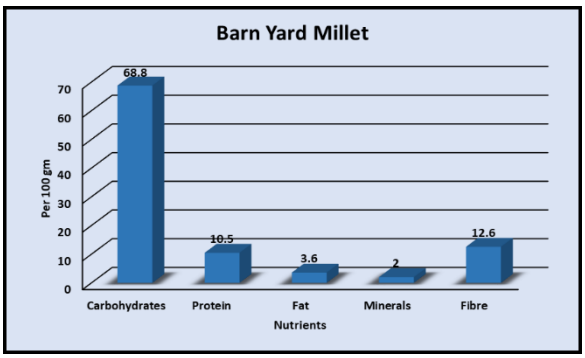
Barn yard millet	
Carbohydrates	68.8
Protein	10.5
Fat	3.6
Minerals	2.0
Fibre	12.6

(Ugare et al., 2011)

Barn yard millet			
Ca	22	**Na**	-
P	280	**Mn**	0.96
Fe	18.6	**Cu**	0.60
Mg	82	**Zn**	3
K	-		

(Chandra et al., 2016)





Foxtail Millet :

Foxtail millet, a widely cultivated and consumed cereal, holds significant economic importance globally, notably in regions like India, China, Asia, North Africa, and the Americas. As a member of the Setaria genus and the Panicoideae subfamily of the Poaceae family, foxtail millet is a crucial cereal grain (Sharma N, 2018). Its gluten-free nature, high protein content, and low carbohydrate composition support the synthesis of the neurotransmitter acetylcholine, facilitating efficient signal transmission between muscles and nerves. This nutritional powerhouse helps maintain stamina, bolster strength, and enhance immunity, making it effective in combating various diseases and promoting overall health.

Foxtail Millet aids in maintaining a steady release of glucose without disrupting the body's metabolism. Its consumption is linked to a reduced prevalence of diabetes, earning it the title of a "healthy heart food" due to its high magnesium content (O.S.K.Reddy, 2017). Foxtail Millet, with its low glycemic index, is effective in managing blood sugar levels. It also showcases significant antioxidant activity and serves as a valuable source of minerals and iron, contributing to a strong and resilient immune system (Singh KP, et al., 2012).

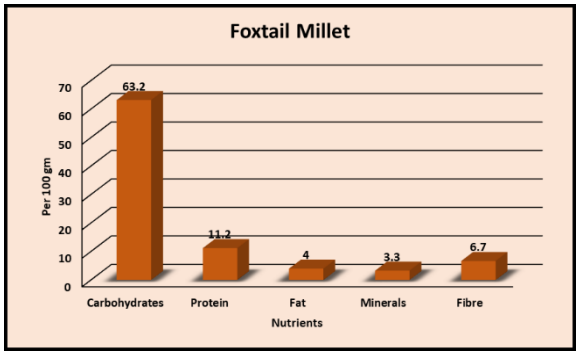
Foxtail Millet		
Botanical name	Setaria italica (L.) P. Beauv ssp. Italica	
Vernacular name	Kauni, KAngni, Korra, Tenai, Rala, Italian, German, Hungarian, Siberian, navane, thanahal	
Origin place	China	
Characteristics	Adapted to low rainfall, high altitude (Up to 2000 m amsl), short duration, tolerant to low fertility and drought	

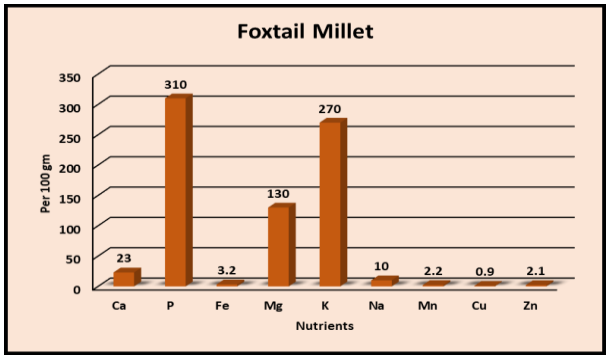
Foxtail Millet	
Carbohydrates	63.2
Protein	11.2
Fat	4.0
Minerals	3.3
Fibre	6.7

(Jaybhaye et al., 2014)

Foxtail Millet			
Ca	23	**Na**	10
P	310	**Mn**	2.2
Fe	3.2	**Cu**	0.9
Mg	130	**Zn**	2.1
K	270		

(Serna-Saldivar et al., 2019)





Little millet :

Little millet, a unique minor cereal, is extensively cultivated in tropical regions and serves as a dietary staple for various low-income groups globally. It offers a comparable nutritional profile to other cereals like rice and wheat, providing protein, fat, carbohydrates, crude fiber, minerals, and vitamins. Additionally, little millet contains important phytochemicals such as flavonoids, phytate, phenolic acids, and tannins (Pradeep SR, 2011).

Little Millet, despite its name, is rich in nutritional content, boasting a good source of B-vitamins, essential minerals such as calcium, iron, zinc, and potassium. Additionally, it provides beneficial fats that aid in weight loss. Its high fiber content makes it a favorable choice, suitable for dishes like pongal or even kheer as a healthy alternative to rice (O.S.K.Reddy, 2017)

Little millet	
Botanical name	Panicum sumatrense Roth. ex Roem. & Schult. Subsp. sumatrense (syn. P. miliare auct. pl.)
Vernacular name	Little millet, Kutki, Samalu, Same, samai, Blue panic, heen meneri

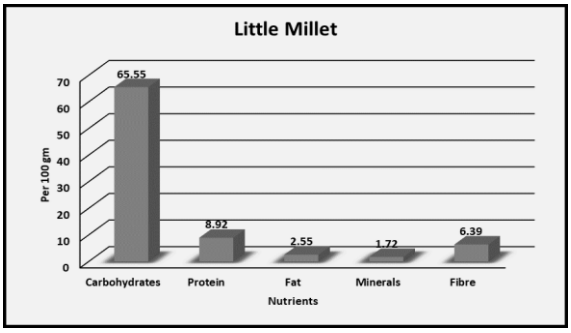
Origin place	India	
Characteristics	short duration, Adapted to low rainfall and poor soils- famine food; withstand waterlogging to some extent, Up to 2000 m amsl	

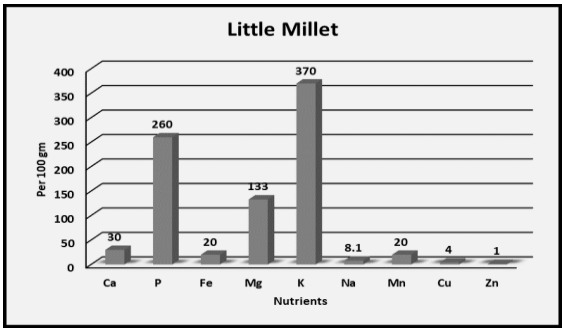
Little millet	
Carbohydrates	65.55
Protein	8.92
Fat	2.55
Minerals	1.72
Fibre	6.39

(Dayakar Rao et al., 2017)

Little millet			
Ca	30	**Na**	8.1
P	260	**Mn**	20
Fe	20	**Cu**	4
Mg	133	**Zn**	1
K	370		

(Himanshu et al., 2018)





Kodo millet :

Kodo millet is believed to have originated in India and was likely first domesticated approximately 3000 years ago (Arendt E, 2011). Known for its resemblance in taste to rice and its weight loss-promoting properties, it has become a staple in traditional diets. Abundant in phytochemicals and antioxidants, kodo millet aids in preventing diseases associated with a sedentary lifestyle (Ambati K, 2019).

Particularly kodo millet beneficial for postmenopausal women dealing with

cardiovascular issues like high blood pressure and excessive cholesterol, it provides essential antioxidants that combat oxidative stress, maintain steady blood sugar levels, and assist in managing diabetes. Moreover, kodo millet has shown promise in treating conditions such as asthma, migraines, heart-related issues, atherosclerosis, and diabetic heart disease due to its rich antioxidant content (Das S, 2019).

Kodo Millet, a traditional food resembling rice, proves beneficial for weight loss due to its easy digestibility. Abundant in phytochemicals and antioxidants, it aids in preventing various lifestyle-related diseases. Furthermore, Kodo Millet assists in alleviating joint and knee pain while aiding in the regular menstrual cycle for women (Deshpande et al., 2015).

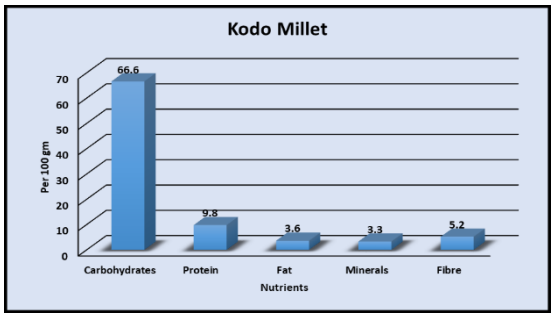
Kodo millet	
Botanical name	Paspalum scrobiculatum L.
Vernacular name	Varagu, bastard, ditch, naraka, water couch, Indian paspalum, creeping paspalum, amu
Origin place	India
Characteristics	Long duration, but very hardy, needs little rainfall, comes up in very poor soils, grown ewll in shallow and deep soil, good response to improved management

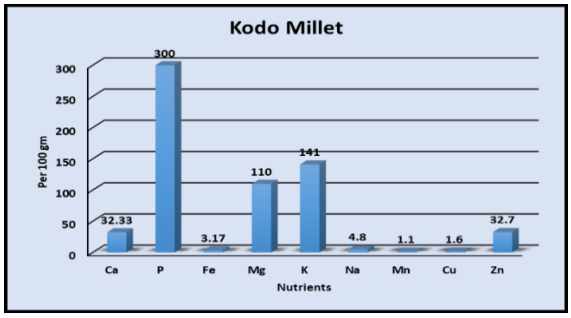
Kodo millet	
Carbohydrates	66.6
Protein	9.8
Fat	3.6
Minerals	3.3
Fibre	5.2

(Saleh et al., 2013)

Kodo millet			
Ca	32.33	**Na**	4.8
P	300	**Mn**	1.10
Fe	3.17	**Cu**	1.60
Mg	110	**Zn**	32.7
K	141		

(Kumar et al., 2018; Chandra et al., 2016)





Proso millet :

Proso Millet, rich in niacin (Vitamin B3), plays a vital role in preventing Pellagra, a skin condition caused by niacin deficiency. This condition leads to dry, scaly, and rough skin. Additionally, Proso Millet is a good source of protein and has been traditionally used as recuperative food, particularly after pregnancy or during illness (Jana Kalinova, 2007).

Proso Millet packs an energy content of 356 Kcal/100 g and a protein content of 12.5%, making it a nutritious choice. Rich in magnesium and phosphorus, it offers potential benefits such as reducing migraine effects and minimizing the risk of heart attacks. Additionally, phosphorus is a crucial component of adenosine triphosphate (ATP), a precursor to energy in the body (The Hindu, 2014).

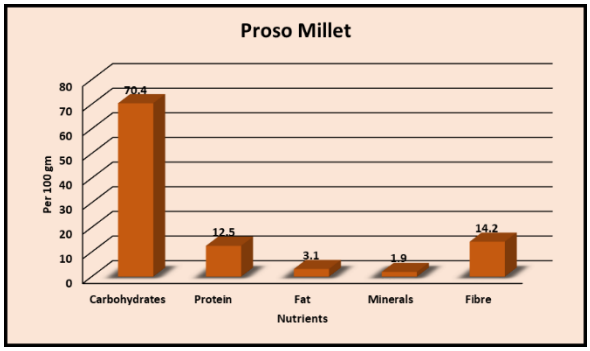
Proso millet	
Botanical name	Panicum miliaceum L. ssp. Miliaceum
Vernacular name	Cheena, Panivaragu, Variga, Baragu Common, hog, broom, samai, Russian, panic, mahameneri
Origin place	China
Characteristics	Short duration, adopted to low rainfall and high altitude area, tolerant to heat and drought

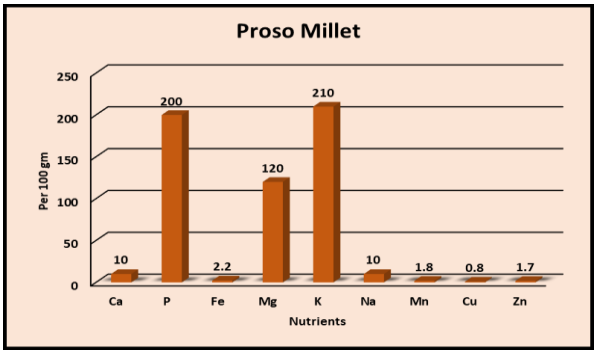
Proso millet	
Carbohydrates	70.4
Protein	12.5
Fat	3.1
Minerals	1.9
Fibre	14.2

(Habiyaremye et al., 2017)

Proso millet			
Ca	10	**Na**	10
P	200	**Mn**	1.8
Fe	2.2	**Cu**	0.8
Mg	120	**Zn**	1.7
K	210		

(Kumar et al., 2018; Serna-Saldivar et al., 2019)





Pearl millet :

Pearl millet, a robust cereal crop compared to wheat and rice, thrives in regions with limited rainfall. It stands as the sixth most vital grain globally, with semiarid regions of Asia and Africa heavily relying on it for sustenance (Upadhyaya HD, 2016). This cereal accounts for a significant 40% of the worldwide grain production (Yang X, 2012). Remarkably, over 95% of pearl millet production occurs in developing nations, prominently led by India with a cultivation area of 9.8 million hectares globally (Rani S, 2018). Its high oil content (4–9%) facilitates convenient storage at low temperatures and minimal moisture levels. Furthermore, pearl millet boasts abundant unsaturated fatty acids, folate, copper, zinc, iron, magnesium, calcium, vitamin B complex, and various other essential minerals [Tiwari H, 2023].

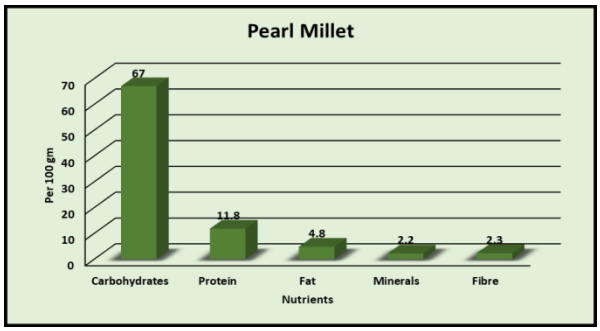
Pearl Millet is recognized for its magnesium content, offering relief to asthma patients by mitigating respiratory issues and alleviating the effects of migraines. The fiber within pearl millet plays a vital role in reducing the occurrence of gallstones. Its insoluble fiber content aids in decreasing excessive bile in the system, thereby preventing gallstone formation (Shweta, 2015).

Pearl millet	
Botanical name	Pennisetum glaucum (L.) R. Br (= P. americium (L))
Vernacular name	Bajra, cattail, bulrush, candlestick, sanyo, munga, seno
Origin place	West African Savannah
Characteristics	Highly resilient to heat and drought, come up in very poor soils, but responsive to high input management

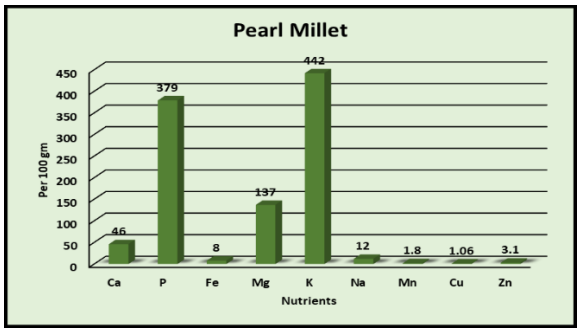
Pearl millet	
Carbohydrates	67
Protein	11.8
Fat	4.8
Minerals	2.2
Fibre	2.3

Pearl millet			
Ca	46	**Na**	12.0
P	379	**Mn**	1.8
Fe	8.0	**Cu**	1.06
Mg	137	**Zn**	3.1
K	442		

(Muthamilarasan et al., 2016)



(Himanshu et al., 2018)



Sorghum :

Sorghum, an ancient cereal grain, holds significant importance as a staple crop in both India and Africa. Notably, it serves as a safe dietary option for individuals dealing with celiac disease or gluten insensitivity. Molecular analysis has confirmed that sorghum grain is entirely devoid of gluten, offering various health advantages, rendering it suitable for diverse diets. Gluten, a protein commonly found in wheat, barley, and rye, lends these grains their characteristic texture in baked goods like bread and pasta.

Sorghum stands as a viable substitute for wheat in the creation of breads, pastas, and similar products. Moreover, research indicates that sorghum, or jowar, plays a role in weight management. Compared to prominent cereals like rice and wheat, jowar boasts a higher calcium content. Additionally, it is a rich source of iron, protein, and dietary fiber. Studies have revealed that sorghum wax contains ample policosanols, aiding in cholesterol reduction. Given its gluten-free nature, it is a preferred choice for individuals with wheat intolerance (O.S.K.Reddy, 2017).

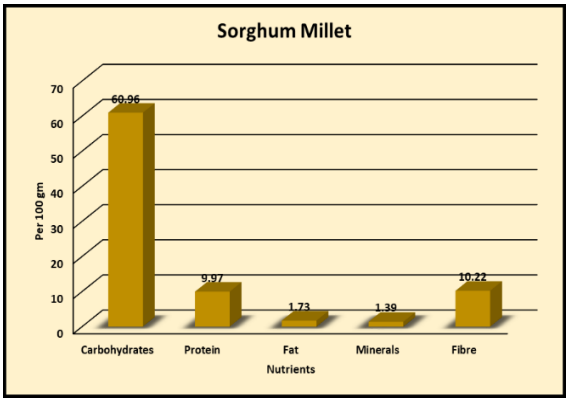
Sorghum	
Botanical name	Sorghum bicolor (L.) Moench ssp. Bicolor
Vernacular name	Great millet, jowar, cholam, jola, jonna, durra, Egyptian millet, feterita, Guinea corn, jwari, juwar, milo, shallu, gaoliang, kaoliang, kafir corn, dura, dari, mtama, solam

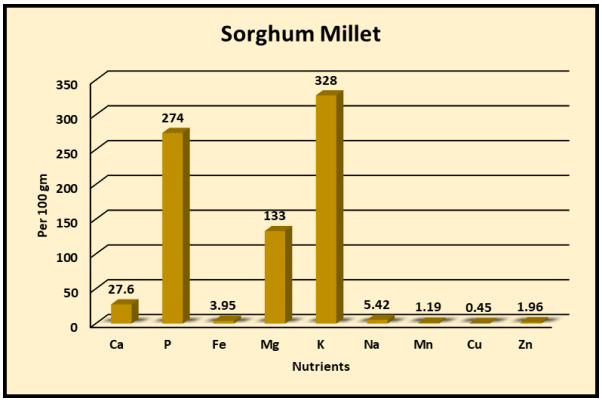
Origin place	African Savannahs	
Characteristics	Drought tolerant, excellent recovery mechanism from stresses, highly adapted to wide range of soils, altitudes and temperatures, responsive to high input management	

Sorghum	
Carbohydrates	60.96
Protein	9.97
Fat	1.73
Minerals	1.39
Fibre	10.22

Sorghum			
Ca	27.60	**Na**	5.42
P	274	**Mn**	1.19
Fe	3.95	**Cu**	0.45
Mg	133	**Zn**	1.96
K	328		

(Indian Food Composition Table)





Brown top millet

Brown top millet	
Botanical name	Brachiaria ramosa (L.) Stapf. (syn. Urochloa ramosa (L.) R. D. Webster)
Vernacular name	Korale
Origin place	South East Asia
Characteristics	Short duration, adapted to poor soils with less rainfall. Seed used as feed for game bird.

Sawa Millet :

Sawa Millet		
Botanical name	Echinochloa colona (L.) Link ssp. frumentacea (Link) (= E. frumentacea Link)	
Vernacular name		
Origin place	Peninsular India	
Characteristics		

Bristley foxtail millet :

Bristley foxtail millet		
Botanical name	Setaria verticillata (L.) P. Beauv	
Vernacular name	Bristley foxtail millet	
Origin place	South India	
Characteristics		

Fonio :

Fonio		
Botanical name	Digitaria exilis (Kippist) Stapf.	
Vernacular name	Fonio, acha, fundi, hungry rice	
Origin place	West Africa	
Characteristics	Shorter duration (70-150 days), Adapted to poorly fertile sandy and stony soils, low rainfall	

Black fonio :

Black fonio		
Botanical name	Digitaria iburua Stapf.	
Vernacular name	Black fonio, iburu, hungry rice	
Origin place	West Africa	

Characteristics	Shorter duration (70-150 days), Adapted to poorly fertile sandy and stony soils, low rainfall	

Tef :

Tef		
Botanical name	Eragrostis tef (Zucc.) Trotter	
Vernacular name	Abyssinian lovegrass	
Origin place	Ethiopian highlands	
Characteristics	Short duration, drought and flood tolerant, high altitude adapted, fit in diverse cropping systems Brown top millet 60-80 Short duration, adapted	

Health benefits of Millets :

Millets and Obesity :

Obesity is a significant emerging concern in India, and it's strongly linked to various chronic diseases, including diabetes and cardiovascular diseases (CVD). Recent research indicates that a high dietary fiber intake can help reduce the incidence of obesity (Alfieri et al., 1995). Foods rich in dietary fiber enhance bowel function and slow down the digestion and absorption processes, consequently lowering the risk of chronic diseases (Ali et al., 1982). Millets stand out in this aspect, boasting a dietary fiber content of 22%, which is notably higher compared to other cereals like wheat (12.6%), rice (4.6%), and maize (13.4%).

Research by Chethan et al. (2007) revealed that finger millet grain contains 15.7% insoluble dietary fiber and 1.4% soluble dietary fiber. Additionally, Shobana et al. (2007) reported that finger millet comprises 22.0% total dietary fiber, with 19.7% being insoluble dietary fiber and 2.5% soluble dietary fiber. It's important to note that dietary fibers are typically classified into soluble and insoluble fibers based on their characteristics and effects on the body.

Millets and Diabetes :

Millets have demonstrated promising results in managing blood glucose levels by

reducing α-glucosidase and pancreatic amylase activities, thereby mitigating postprandial hyperglycemia through decreased enzymatic hydrolysis of complex carbohydrates. They also affect enzymes like aldose reductase, playing a role in preventing the accumulation of sorbitol and reducing the risk of diabetes-induced cataract diseases. Consequently, the consumption of millets aids in controlling blood glucose levels and supports the dermal wound healing process, attributed to their antioxidant properties (Rajasekaran NS, et al., 2004). These findings highlight the potential of millets in the dietary management of diabetes and related complications.

Millets and Cardio-Vascular Disease :

Consuming porso-millet protein concentrate has been shown to have a positive effect on plasma lipid levels. Research conducted by Kyung et al. (2008) demonstrated that the intake of porso-millet protein concentrate resulted in elevated levels of plasma high-density lipoprotein cholesterol and adiponectin, indicating potential benefits for cardiovascular health.

Millets also serve as a valuable source of magnesium, known for its role in reducing the risk of heart attacks. Furthermore, millets are rich in phytochemicals, including phytic acid, which has been linked to lowering cholesterol levels and aiding in the prevention of cardiovascular diseases by reducing plasma triglycerides (Lee et al., 2010). Accumulating evidence suggests that regular consumption of whole millet grains can contribute to a decreased risk of cardiovascular diseases, reinforcing their potential as a heart-healthy dietary choice.

Millets and Cancer :

Millets exhibit richness in phenolic acids, phytates, and tannins, which are considered antinutrients that contribute to reducing the risk of colon and breast cancer. Research has highlighted that the phenolics found in millets play an effective role in preventing cancer initiation and progression in vitro (Chandrasekara A, et al., 2011). Additionally, millets contain linoleic acid, which has demonstrated anti-tumor activity (Nobihoru et al., 2007).

Sorghum, another member of the millet family, has been extensively studied for its anti-carcinogenic properties. The polyphenols and tannins present in sorghum have been shown to possess anti-mutagenic and anti-carcinogenic properties (Grimmer et al., 1992). These findings emphasize the potential of millets and related grains in contributing to cancer prevention and overall health.

Millets and Celiac disease :

Millets play a crucial role in assisting individuals with celiac disease, a genetically susceptible problem triggered by gluten consumption. Since millets are gluten-free, they can help alleviate the irritation caused by common cereal grains that contain gluten (Saleh ASM, et al., 2013). Their gluten-free nature of millets have significant potential in the production of foods and beverages, meeting the increasing demand for gluten-free options and catering to the dietary needs of those with celiac disease. This makes millets an excellent choice for

individuals seeking gluten-free alternatives to traditional cereal grains.

Conclusion :

This article provides an up-to-date summary of recent research conducted on millet grain production and nutritional quality, emphasizing their significance as a staple food. It is indeed well-established that the world is facing significant health challenges due to a lack of fiber in diets. Many patients have experienced the transformation of lifestyle diseases by incorporating millets into their daily meals, while eliminating refined foods such as rice, wheat, refined flours, processed meats, refined oils, and packaged ready-to-consume foods, including milk. Millets, ancient grains with numerous health benefits, should be integrated into our regular diets.

Despite being a treasure of ancient wisdom, millets are relatively unknown to a majority of the population.. Millets are even mentioned as prized crops in the Bible. The aim of this study is to emphasize the importance of food and introduce millets as a nutritious food source, catering to the nutritional needs of the global population and addressing malnutrition and other health issues. Furthermore, the presence of bioactive compounds in millets positions them as potential contributors to the reduction of various diseases such as cardiovascular issues, diabetes, high blood pressure, and certain types of cancers. Millets are gaining prominence as substitutes for major cereals due to their gluten-free and celiac-friendly properties, making them a preferred choice for patients and health-conscious individuals.

Moreover, millets hold promise for bio-fortification strategies aimed at enhancing their nutrient content. The article underscores the need for future research to delve deeper into gathering fundamental information about millets and their diverse properties. Expanding knowledge in this domain will pave the way for better utilization and integration of millets into dietary practices, potentially addressing health challenges and improving overall nutrition.

References :

- A. Adekunle et al., Agricultural innovation in Sub-Saharan Africa : experiences from multiple stakeholder approaches. Accra, Ghana: FARA, 2012, p. 160. 11
- Alfieri, M.A.H., Pomerleau, J., Grace, D. M. and Anderson, L. (1995) Fiber intake of normal weight, moderately obese and severely obese subjects. Obesity Research. 3(6): 541-547.
- Ali, R., Staub, J., Leveille, G. A. and Boyle, P.C. (1982) Dietary fiber and obesity. In: Vahouny, G. V. and Kritchevsky, D. (ed) Dietary Fiber in Health and Disease Plenum Press, New York, pp: 192-194.
- Ambati K, Sucharitha KV. Millets-review on nutritional profiles and health benefits. International Journal of Recent Scientific Research. 2019;10(7):33943- 33948.
- Annonymous. The Story of Millets Millets were the first crops Millets are the future crops. Published by: Karnataka State Department of Agriculture, Bengaluru, India

with ICAR-Indian Institute of Millets Research, Hyderabad, India (Accessed online), 2018.

- Arendt E, Dal Bello F. Gluten-Free Cereal Products and Beverages. Elsevier; 2011.
- Chandra D, Chandra S, Sharma AK. Review of Finger millet (Eleusine coracana (L.) Gaertn): A power house of health benefiting nutrients. Food Science and Human Wellness. 2016;5(3):149-155.
- Chandrasekara A & Shahidi F (2011). Antiproliferative potential and DNA scission inhibitory activity of phenolics from whole millet grains. Journal of Functional Foods: 3: 159-170.
- Consume Millets for Healthy life- The Hindu, April 6. 2014.
- Das S, Khound R, Santra M, Santra DK. Beyond bird feed: Proso millet for human health and environment. Agriculture. 2019; 9(3):64.
- Dayakar Rao B, Bhaskarachary K, Arlene Christina GD, Sudha Devi G, Vilas AT, Tonapi A. Nutritional and health benefits of millets. ICAR_ Indian Institute of Millets Research (IIMR): Hyderabad, Indian, 2017, 112.