MILLETS: The Superfood for the future

KRISHI VIGYAN KENDRA

EAST KHASI HILLS, 5TH MILE, UPPER SHILLONG

Introduction

Millets are small, hardy grains that belong to the *Poaeceae* family. Millets are types of grains that can withstand changing weather conditions and need less water and fertilizer than other conventional grains such as rice and wheat. They are also very nutritious and are often called "nutri cereals" or "super foods." Despite all of these benefits and their historically bigger share in diets across geographies, the cultivation and consumption of millets is sharply declining. This is a problem because millets could play a key role in ensuring food and nutrition security, resource sustainability and economic empowerment.

It is therefore imperative to develop policies that reverse the global trend of declining millet consumption and production and to raise consumer awareness about the nutritional and health benefits of millets. The United Nations has declared 2023 as the ‘International Year of Millets’, which is an opportunity to bring this "superfood" to the forefront of human dietary habits.

Millets are a type of grain that have been grown for about 5000 years; especially in India, China and Nigeria. They have numerous benefits such as being nutritious, climate-resilient and water-efficient. However, millets are not widely grown or consumed around the world.

Before the ‘Green Revolution’, millets were a major part of the global food supply. However, the Green Revolution focused on increasing the production of wheat and rice and thus millets were largely forgotten.

Today millets could play an important role in promoting sustainable agriculture. They can be grown in a variety of climates including harsh and dry environments. They also require less water than other grains, such as rice. For example, As compared to the requirement of 5000 litres of water to grow 1 kg of rice, millets require only between 650-1200 litres of water.

Production of millets in India:

India is the world's largest producer of millets, with a production of approximately 12 million tons in 2020-21. The major millet-growing states in India are Karnataka, Maharashtra, Rajasthan, Punjab, Uttar Pradesh, and Gujarat. Karnataka is the largest producer of finger millet, with a production of 3.4 million tons.

Common millets in India:

	
Finger millet	**Pearl Millet**

	
Sorghum	**Foxtail Millet**
	
Kodo Millet	**Banyard Millet**
	
Proso Millet	**Little Millet**

Meghalaya produced about 2,723 MT of millets in 2019-2020. The most common types of millets grown in Meghalaya are finger millet, foxtail millet, pearl millet, Job's tears and little millet.

Production of millets in Meghalaya

Crop	Area (ha)	Production (MT)	Productivity (kg/ha)
Finger millet	926	950	1026
Foxtail millet	1551	328	862
Pearl millet	321	41	1022
Jobs' tear	50	67	820
Other millet	45	67	1489
Total in millets	2893	2723	943

(Source: Directorate of Economics & Statistics, State level crop statistics Report 2019-2020)

A brief description of the millets available in the North East region is provided below:

(a) Finger millet (Scientific name: *Eleusine coracana)* ranks sixth in production after wheat, rice, maize, sorghum and bajra in India. It has different names in local languages. It is called 'Raitruh' in Khasi. It is a source of natural calcium which helps to make bones stronger for the aged and growing children, and a great source of natural iron which helps in recovery of anaemia.

(b) Fox-tail millet (Scientific name: *Panicum italicum L.)* is the second-most widely planted species of millet and the most cultivated millet species in Asia. Foxtail millet has been grown in India since the middle ages. In the Khasi vernacular, foxtail millet is known as 'Raisoh'. It provides health benefits as it is good for thyroid problems, provides wholesome nutrition to children, it is also easily absorbed and digested and is also said to cures anaemia as it contains high iron and calcium.

- **Pearl millet** (*Pennisetum glaucum (L.) R. Br.)* is the sixth most important cereal crop after rice, wheat, maize, barley and sorghum. It is widely grown on 30 million hectares of dry regions of Asia and Africa accounting for almost half of the global millet production. Pearl millet is also nutritionally superior and rich in micronutrients such as iron and zinc and can mitigate malnutrition and hidden hunger.

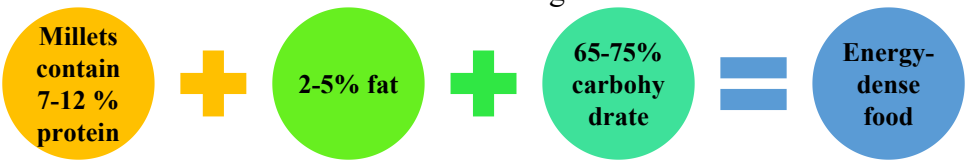
- **Little millet** (*Panicum sumatrense Roth ex Roemer and Schultes*) is a minor millet which belongs to the family of Poaceae (Gramineae) and commonly known as 'Raishan' in Khasi vernacular. Seeds of these millets are very small but easy to harvest and highly nutritious. Apart from its use in food products, it has huge potential to being used as medicinal supplement. The high productivity of this millet in various parts of India has ensured its use in various food products and also non-food purpose because of its multi-nutritional value.

- **Jobs' tear**(Scientific name *Coixlacryma-jobi L*) , also known as adlay and coix, is a member of the grass family and popular in Asian cultures as a food source and for making jewellery. But the plant has also been used for centuries in folk medicine to treat dozens of conditions from arthiritis to small pox. Coix was rather widely cultivated as cereal in India. It is still considered as a minor cereal. After harvest, it is pounded, threshed and winnowed to be used as a cereal or breadstuff. The pounded flour is sometimes mixed with water like barley for barley water.

Nutritional importance of millets

The Government of India has renamed millets as “nutri cereals” to remove the lingering perception that these grains are inferior to rice and wheat. The word "nutri" emphasizes that these grains are more nutritious than other grains this will help promote the consumption of these nutritious grains.

Millets are a powerhouse of nutrients. They are a good source of carbohydrates, protein, fibre and healthy fats. The presence of 7-12 % protein, 2-5% fat and 65-75% carbohydrate makes them energy-dense and an excellent choice for fortification against malnutrition.

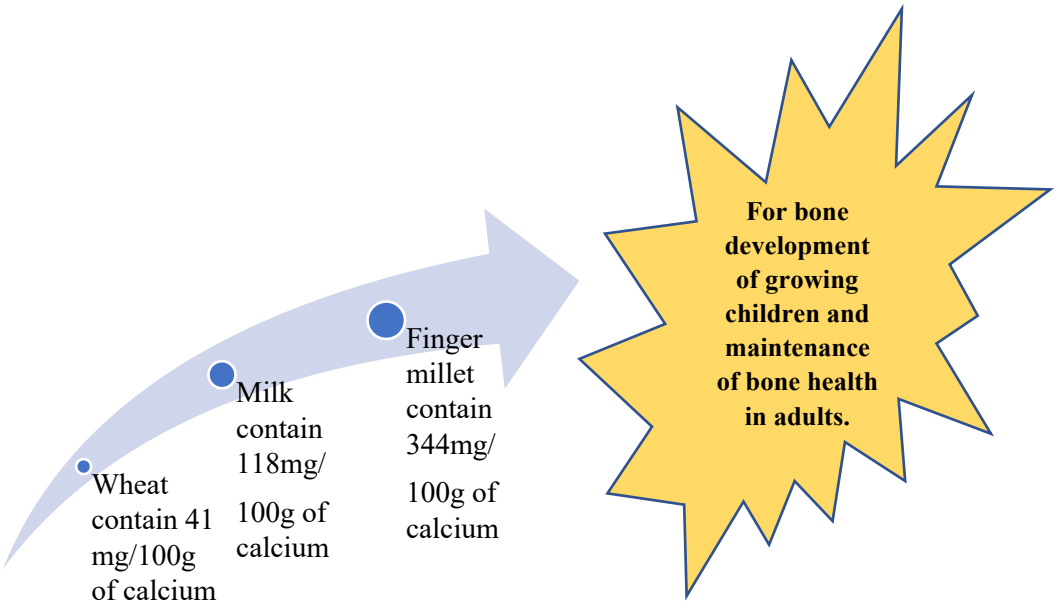


Nutritional content of millets in comparison to other cereals

Millets and Cereals	Energy (Kcal)	Carbohydrates (g)	Protein (g)	Fat (g)
Sorghum	334	67.68	9.97	1.73
Pearl millets	348	61.78	10.96	5.43
Finger millets	321	66.82	7.16	1.92
Little Millet	346	65.55	10.13	3.89
Kodo Millet	331	66.19	08.92	2.55
Foxtail Millet	331	60.09	12.3	4.3
Barnyard Millet	307	65.5	6.2	2.2
Proso Millet	341	70.04	12.50	1.10
Maize (Tender)	120	22.69	3.57	1.40
Wheat flour	320	64.17	10.57	1.53
Refined flour	352	74.27	10.36	0.76
Rice, parboiled	352	77.16	7.81	0.55
Rice, raw, milled	356	78.24	7.94	0.52

Source: Indian Food Composition Tables, NIN – 2017 and *Nutritive value of Indian foods, NIN – 2007

Millets are a good source of minerals including calcium, potassium, magnesium, iron, manganese, zinc, and B vitamins. Finger millet has the highest calcium content of all the millets with 344 mg per 100 grams. This is 10 times more than wheat (41mg/100g), maize (6.35 mg/100g), rice (10mg/100g) and three times more than milk. For this reason, it is known as poor man's milk and consumption of finger millet helps in development of bones in growing children and in maintenance of bone health in adults. Millets also contains a very good natural source of iron and its consumption helps in amelioration of anemia.



Minerals and vitamins content of millets in comparison to other cereals

Millets and Cereals	Calcium (mg)	Iron (mg)	Vitamin B1 (Thiamine) (mg)	Vitamin B2 (Riboflavin) (mg)	Vitamin B3 (Niacin) (mg)	Vitamin B5 (Pantothenic Acid) (mg)	Vitamin B6 (Pyridoxine) (mg)	Vitamin B9 Folates (µg)
Sorghum	27.35	6.42	0.35	0.14	2.10	0.27	0.28	39.42
Pearl millets	27.60	3.95	0.25	0.20	0.86	0.50	0.27	36.11
Finger millets	364	4.62	0.37	0.17	0.34	10.29	0.05	0.88
Little Millet	16.06	1.26	0.26	0.05	1.29	0.60	0.04	6.03
Kodo Millet	15.27	2.34	0.29	0.20	1.49	0.63	0.07	1.49
Foxtail Millet	31	2.8	0.59	0.11	3.20	-	-	15.0
Barnyard Millet	20	5.0	0.33	0.10	4.20	-	-	-
Proso Millet	14	0.8	0.20	0.18	2.3	-	-	-
Maize, Tender	6.35	0.71	0.17	0.12	1.13	0.35	0.45	62.96
Wheat flour	30.94	4.10	0.42	0.15	2.37	0.87	0.25	29.22
Refined flour	20.4	0.77	0.15	0.06	0.77	0.72	0.08	16.25
Rice, (parboiled)	8.11	0.72	0.17	0.06	2.51	0.55	0.22	9.75
Rice (raw, milled)	7.49	0.65	0.05	0.05	1.69	0.57	0.12	9.32

Source: Indian Food Composition Tables, NIN – 2017 and *Nutritive value of Indian foods, NIN – 2007

Health benefits of millets

Millets are a good source of slow-digesting starch and fibre which can help manage celiac disease and diabetes. The high fibre content in millets slows down the digestion process, which allows people to feel full for longer and reduces the risk of overeating. This can help with weight loss. Millets also have a lower Glycemic Index than other cereal crops which means they do not cause a sudden spike in blood sugar levels. This makes them a good choice for people with diabetes or prediabetes.

Fibre content of millets in comparison to other cereals

Millets and Cereals	Total Fibre/Crude fibre (g)	Insoluble Fibre (g)	Soluble Fibre (g)
Sorghum	10.22	8.49	1.73
Pearl millets	11.49	9.14	2.34
Finger millets	11.18	9.51	1.67
Little Millet	7.72	5.45	2.27
Kodo Millet	06.39	4.29	2.11
Foxtail Millet	8.0	-	-
Barnyard Millet	9.8	-	-
Proso Millet	2.2	-	-
Maize (Tender)	3.67	3.23	0.43
Whole wheat flour	11.36	9.73	1.63
Refined flour	2.76	2.14	0.62
Rice (parboiled)	3.74	2.98	0.76
Rice (raw, milled)	2.81	1.99	0.82

Source: Indian Food Composition Tables, NIN – 2017 and *Nutritive value of Indian foods, NIN – 2007

Millets for people with celiac disease

Celiac disease is a condition in which a person cannot tolerate even a small amount of gluten in his/her diet. Unfortunately, most of the common grains like rice, wheat, etc have gluten present in them. Millets are the only type of grains which do not have any gluten present. Thus this is suitable for people with celiac disease.

Anti-nutrients in millets

Millets are a nutritious food, but they also contain anti-nutrients that can reduce the body's ability to absorb nutrients. Some common anti-nutrients in millets include phytic acid, polyphenols, cyanogenic glucosides, tannins, oxalates, and amylase inhibitors.

One way to reduce the levels of anti-nutrients in millets is to use household food processing techniques such as fermentation, malting, germination, and decortication. These techniques can help to improve the bioavailability of nutrients in millets, making them more nutritious and easier for the body to digest.

HOW TO INCORPORATE MILLET INTO OUR DAILY DIET?

Millets are like cereals in that they are grains that can be cooked and eaten. They can be prepared into a variety of recipes, similar to other cereals.

Here are some examples of recipes that can be made with millet:

Finger Millet Biscuit

Ingredients

- Millet flour-90g
- Butter- 60g
- Sugar- 38 g
- Egg- 2-3 teaspoons
- Baking powder- ½ teaspoon
- Cocoa powder- 10 g

Finger Millet Biscuit

Process of making:

- Roast the millet flour slightly.
- Sieve the roasted millet flour, cocoa powder, and baking powder together.
- Grind the sugar into powder.
- Whisk the egg.
- Add the butter and sugar to the flour mixture and mix until well combined.
- Add the egg and mix until a dough forms.
- Flattened the dough and cut into cookie shapes
- Bake in a preheated oven at 180 degrees Celsius for 18-20 minutes.
- Let cool completely before serving.

Finger Millet Cupcake

Ingredients

Finger millet flour- 1.5 cups (200ml cup)

Mashed banana- 1.5 cups

Sugar- 1 cup (50 g)

Cocoa powder- ¼ cup

Refine Oil-1/3 cup

Baking powder- 1 teaspoon

Vanilla extract- 1 teaspoon

Egg- 1

Milk- ¼ cup

Finger Millet Cupcake

Process of making:

- Roast the millet flour slightly. This will give the cake a nutty flavor. You can do this in a pan over medium heat, stirring constantly, until the flour is fragrant and slightly golden brown.
- Sieve the roasted millet flour, cocoa powder, and baking powder together. This will help to evenly distribute the ingredients and remove any clumps.
- Grind the sugar into powder. This will make the cake smoother and more tender. You can do this in a food processor or blender.
- Mash the banana. This will help to incorporate the banana flavor into the cake. In a separate bowl, whisk together the sugar, oil, and egg. This will help to aerate the batter and make the cake light and fluffy.
- Add the mashed banana and whisk until well combined. Then, add the flour mixture and combine well. Do not over mix, as this can make the cake tough. Add vanilla extract
- Pour the batter into the cupcake papers and bake at 180 degrees Celsius for 18-20 minutes or steam for 20 minutes.

‘Ja sahor kyndeh’

This **dish** is a traditional Khasi recipe that is made with finger millet flour, potato or any indigenous vegetable, turmeric and salt. It is a specialty dish that is similar to “Jadoh” and is typically eaten during naming ceremonies and other festivals. To make the dish more nutritious, pulses such as soybeans, bengal gram and lentils can be added. Pulses are a good source of protein and can help to make the dish more filling. This recipe is also good for school children as millet is a powerhouse of nutrients.

Ingredients

- Finger millet flour- 1kg
- Potato- 250 g
- Soyabean/Lentil/Bengal gram- 250g
- Onion- 100g
- Ginger- 50g
- Turmeric- 1 teaspoon
- Garlic chives- 50 g (optional)

‘Ja sahor kyndeh’

Process of making:

- Boil the soyabeans or lentils or bengal gram. This can be done in a pot on the stove or in a pressure cooker. The beans should be cooked until they are soft and mushy.
- Add the potatoes or any vegetables. You can use any type of vegetable that you like, such as carrots, peas, or cauliflower. Cut the vegetables into small pieces so that they cook evenly.
- Add the turmeric powder, onion, and ginger. Turmeric powder gives the dish its characteristic yellow color. The onion and ginger will flavour to the dish.
- Cook the vegetables until soft. Stir the vegetables occasionally so that they cook evenly.
- Add the finger millet flour.
- Cook the finger millet flour over low heat, stirring constantly. This will help to prevent the flour from clumping together. Add garlic chives.
- Cook for 5-7 minutes, or until the finger millet flour is cooked through. The dish should be thick and smooth.

Millet Pancake

Millet Pancake

Ingredients

- Finger millet flour: 1cup
- Egg- 1 no
- Milk- ½ cup (100ml)
- Sugar- 5 teaspoons
- Baking powder- 1 teaspoon
- Vanilla extract- 3-4 drops

Process of making

- To make millet pancakes, first roast the millet flour slightly in a pan over medium heat. This will give the pancakes a slightly nutty flavor.
- Next, beat the egg until frothy. Then, sieve the millet flour and baking powder together.
- Add the beaten egg, milk, and vanilla extract to the flour mixture and mix well to form a batter. The batter should be thick and smooth.
- Heat a non-stick pan over medium heat. Add a small amount of butter or oil to the pan.
- Scoop a spoonful of batter onto the pan and cook for 2-3 minutes per side, or until golden brown.
- Repeat with the remaining batter. Serve the pancakes hot with your favourite toppings, such as honey, fruit, or yogurt.

Finger millet (ragi) malt

Malting is the process of soaking grains in water and allowing them to germinate. During germination, the grains produce enzymes that break down fats, protein and starch, making them more digestible. They also produce vitamins and minerals that are not present in the unmalted grains. Malting finger millet improves its nutritional value and enhances the digestive enzymes. It is an ideal base for preparing weaning foods, infant foods and malted milk foods. The flour of malted finger millet can also be used to prepare biscuits, cakes, pancakes, 'ja sahor kyndeh' and other foods.

Process of malting:

- The quality of the finger millet is important. The grains should be clean, free of broken or damaged grains, and have good germination.
- First wash the grain in water. Then soak the grains in clean and soft water in a container for 18-24 hours. Change the water twice or thrice during this time. After the required soaking period remove the grains and wash them again.

- After draining the excess water, the grains are spread out on a gunny bag or thick cloth in a single layer. They are allowed to germinate for 36-48 hours, depending on the temperature and humidity. It is advisable to cover the grains with another cloth to promote uniform germination.
- During germination, the sprouts should be kept moist by sprinkling water as needed. Two days of germination is sufficient for finger millet. If germination is allowed to continue for too long the roots and shoots will grow too long and cause significant malting loss
- After the required germination period, the grains are dried in the sun by spreading them thinly on a cloth. Six to eight hours of sun drying should be sufficient. Soon after drying, the rootlets are removed by rubbing the grains gently against a dry, clean cloth. The separated rootlets are then aspirated, leaving behind the malted finger millet
- Malted finger millet should be mildly toasted in an iron pan heated at low flame.
- The roasted grain is grinded into fine flour and sieved

The shelf life of raw millet flour is short, about 1-2 months for most types of millet and only 5-7 days for pearl millet. This is because millet flour has a high free-fat and sugar content, which makes it prone to oxidative rancidity. However, the shelf life of millet can be extended to 6-12 months through the process of malting or germination.

Prepared by

Shri L. V. Khonglah
Senior Scientist & Head
Krishi Vigyan Kendra
East Khasi Hills

Smti E. Shadap
Subject Matter Specialist (Home Science)
Krishi Vigyan Kendra
East Khasi Hills

Smti A. Lyngdoh
Subject Matter Specialist (Agronomy)
Krishi Vigyan Kendra
East Khasi Hills

Reference:

Amadou, I., Gounga, M. E., and Le, G. W. (2013). Millets: nutritional composition, some health benefits and processing - a review. Emir. J. Food Agric. 25, 501–508

APEDA, E-catalogue for export of millets and value added products, North Eastern States

Frontier in Plant Science 13 September 2021,Sec Plant Breeding,Vol 12-2021

Jakku Prasanna, Mirza I. A. B, A.D.Pandagale; Millets as Climate Resilient Crops:Agriculture and food E-Newsletter; vol 2 issue 9,2020;595-596

Job's Tears: An unexploited Multipurpose Shrub in North Eastern Hilly Region of India, Rakesh Kumar, Narendra Kumawat and U. N. Shukla; Popular Kheti vol.2 issue 4 Oct-Dec 2014

Kole, C., Muthamilarasan, M., Henry, R., Edwards, D., Sharma, R., Abberton, M., et al. (2015). Application of genomics-assisted breeding for generation of climate resilient crops: progress and prospects. Front. Plant Sci. 6:563

Chand, A. & Thapak, G. (2023). Millets as a Key to Improving Food and Nutrition Security and Promoting Sustainable Consumption. https://www.orfonline.org/wp-content/uploads/2023/07/Millets-Key-Food-Security.pdf

ICAR- Indian Institute of Millet Research (2020) Latest millets production and processing technologies. https://www.millets.res.in/farmer/Latest_Millet_English_Full_Book_2020.pdf

Food Safety and Standards Authority of India. (2019). Millets- The Nutri-cereals. Guidance Note no.12 /2019. https://www.fssai.gov.in/upload/uploadfiles/files/Guidance_Notes_Version_2_Millets_29_01_2020.pdf

Longvah, T., Ananthan, R., Bhaskarachary, K. & Venkaiah, K. (2017). Indian Food Composition Tables. National Institute of Nutrition- ICMR. Hyderabad.

Gopalan, C., Sastri, B. V. R. & Balasubramanian, S. C. (2007). Nutritive value of Indian foods. National Institute of Nutrition- ICMR. Hyderabad.