

Millets – The Nutri-cereals

SUMMARY

Millets are group of small grained cereal food crops which are highly tolerant to drought and other extreme weather conditions and are grown with low chemical inputs such as fertilizers and pesticides. Most of millet crops are native of India and are popularly known as Nutri – cereals as they provide most of the nutrients required for normal functioning of human body. Millets are classified into Major Millets and Minor Millets based on their grain size. Pseudo millets are so called because they are not part of the Poaceae botanical family, to which ‘true’ grains belong, however they are nutritionally similar and used in similar ways to ‘true’ grains.

Ministry of Agriculture and Farmers Welfare has recognized the importance of Millets and declared Millets comprising of Sorghum (Jowar), Pearl Millet (Bajra), Finger Millet (Ragi/Mandua), Minor Millets i.e., Foxtail Millet (Kanngani/kakun), Proso Millet (Cheena), Kodo Millet (Kodo), Barnyard Millet (Sawa/Sanwa/Jhangora), Little Millet (Kutki), Brown top millet and two pseudo millets i.e., Buck- wheat (Kuttu), Amaranth (Chaulai)) as “Nutri-Cereals” for production, consumption and trade point of view.

India celebrated 2018 as ‘The Year of Millets’ and the Food and Agricultural Organization (FAO) has declared 2023 as “International Year of Millets”. All these substantiate the importance of millets.

Millets are gluten free and non- allergenic. Millet consumption decreases triglycerides and C- reactive protein, thereby preventing cardiovascular disease. All millets are rich in dietary fibre. Dietary fibre has water absorbing and bulking property. It increases transit time of food in the gut which helps in reducing risk of inflammatory bowel disease and acts as detoxifying agent in the body.

KEY TAKEAWAYS

- Most of millet crops are native of India and are group of small grained cereal food crops which are highly nutritious.
- Millets are popularly known as Nutri – cereals as they provide most of the nutrients required for normal functioning of human body.
- Millets are Gluten free and good for people who are gluten-intolerant.
- Prefer to buy Multi grain processed food products like Multigrain Atta, Multigrain Biscuits, Multigrain Bread etc having millets as one of the ingredient.
- Don’t buy, if odour is unpleasant and taste is bitter or gritty.
- Avoid millets if living or dead insects are visible in the product.
- Prefer millets in packed form and certified under AGMARK.
- Check FSSAI license number on the package label.
- Always read the manufacturing/ packaging date and best before date before buying.
- Look for FSSAI Organic logo (Jaivik Bharat) on the pack while buying organic food products.

This Guidance Note has been prepared by Ms. Aprajita Verma, Technical Officer at FSSAI under guidance of Dr. S.C. Khurana, Consultant at FSSAI. This note contains information collected and compiled by the author from various sources and does not have any force of law. Errors and omissions, if any can be kindly brought to our notice.

I. Introduction

Milletts are traditional grains, grown and consumed in the Indian subcontinent from the past more than 5000 years. Milletts are small-grained, annual, warm-weather cereals belonging to grass family. They are rain-fed, hardy grains which have low requirements of water and fertility when compared to other popular cereals. They are highly tolerant to drought and other extreme weather conditions.

Milletts are nutri cereals comprising of sorghum, pearl millet, finger millet (major millets) foxtail, little, kodo, proso and barnyard millet (minor millets). These are one of the oldest foods known to humanity. These are one of the several species of coarse cereal grasses in the family Poaceae, cultivated for their small edible seeds. Pseudo millets are so called because they are not part of the Poaceae botanical family, to which ‘true’ grains belong, however they are nutritionally similar and used in similar ways to ‘true’ grains.

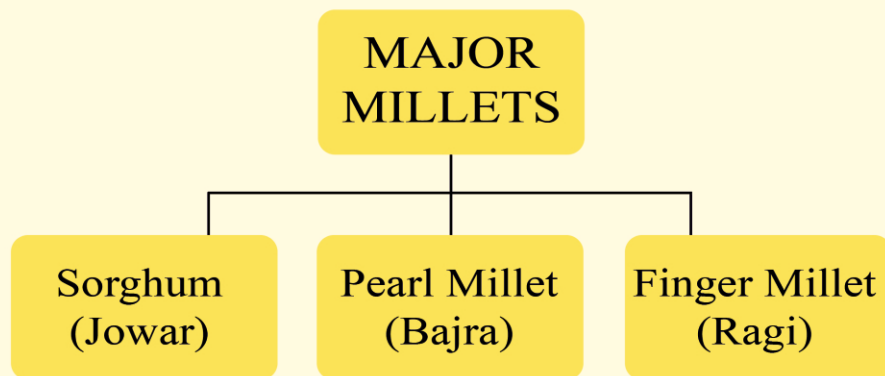
Milletts are highly nutritious, non-glutinous and non acid forming foods. Milletts have many nutraceutical and health promoting properties especially the high fibre content. Milletts act as a prebiotic feeding for micro-flora in our inner ecosystem. Milletts hydrate our colon to keep us from being constipated. Niacin in millet can help lower cholesterol. Milletts contain major and minor nutrients in good amount along with dietary fibre. Milletts are gluten free and can be a substitute for wheat or gluten containing grains for celiac patients.

II. Nutritional composition of various types of Milletts with their local name

Milletts are high in nutrition and dietary fibre. They serve as good source of protein, micronutrients and phytochemicals. The millets contain 7-12% protein, 2-5% fat, 65-75% carbohydrates and 15-20% dietary fibre. The essential amino acid profile of the millet protein is better than various cereals such as maize. Milletts are very good sources of micronutrients such as vitamins and minerals. Milletts contain fewer cross-linked prolamins, which may be an additional factor contributing to higher digestibility of the millet proteins.

Similar to cereal proteins, the millet proteins are poor sources of lysine, but they complement well with lysine-rich vegetables (leguminous) and animal proteins which form nutritionally balanced composites of high biological value. Milletts are more nutritious compared to fine cereals. Small millets are good source of phosphorous and iron.

Milletts contributes to antioxidant activity with phytates, polyphenols, tannins, anthocyanins, phytosterols and pinacosanols present in it having important role in aging and metabolic diseases. All millets possess high antioxidant activities.



• Sorghum (Jowar)

- Major portion of sorghum protein is prolamins (kaffirin) which has a unique feature of lowering digestibility upon cooking which might be a health benefit for certain dietary groups.



English : Sorghum
 Hindi : Jowar, Jowari
 Bengali : Jowar
 Gujarati : Jowari, Juar
 Kannada : Jola
 Marathi : Jowari, Jondhala
 Oriya : Juara
 Punjabi : Jowar
 Tamil : Cholam
 Telugu : Jonna

- Sorghum proteins upon cooking are significantly less digestible than other cereal proteins, which might be a health benefit for certain dietary groups.
- It is rich in protein, fibre, thiamine, riboflavin, folic acid, and β -carotene.
- It is rich in potassium, phosphorus and calcium with sufficient amounts of iron, zinc and sodium.

• Pearl Millet (Bajra)

- Pearl millet contains considerably high proportion of proteins (12-16%) as well as lipids (4-6%).
- It contains 11.5% of dietary fiber. It increases transit time of food in the gut. Hence, reduce risk of inflammatory bowel disease.



English : Pearl Millet
 Hindi : Bajra
 Bengali : Bajra
 Gujarati : Bajri
 Kannada : Sajje
 Marathi : Bajri
 Oriya : Bajra
 Punjabi : Bajra
 Tamil : Kambu
 Telugu : Sajja

- The niacin content in pearl millet is higher than all other cereals.
- It also contains foliate, magnesium, iron, copper, zinc and vitamins E and B-complex. It has high energy content compared to other millets.
- It is also rich in calcium and unsaturated fats which are good for health.

• Finger Millet (Ragi)

- Finger millet is the richest source of calcium (300-350 mg/100 g)

- Ragi has the highest mineral content.

- It contains lower levels of protein (6-8%) and fat (1.5-2%).

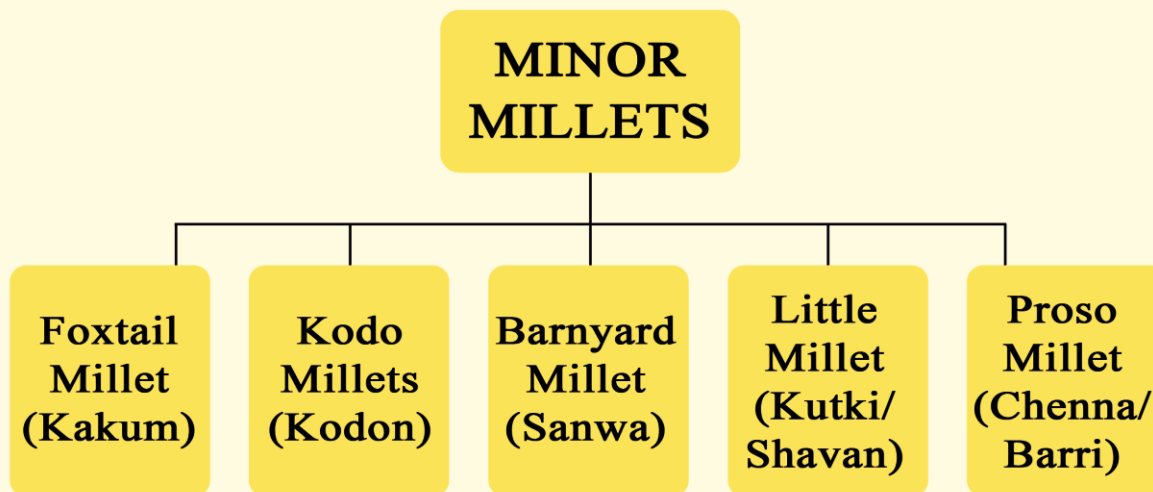


English : Finger Millet
 Hindi : Ragi, Mandika, Marwah
 Bengali : Marwa
 Gujarati : Nagli, Bavto
 Kannada : Ragi
 Marathi : Nagli, Nachni
 Oriya : Mandia
 Punjabi : Mandhuka, Mandhal
 Tamil : Keppai, Ragi, Kelvaragu
 Telugu : Ragi Chodi

- Finger millet proteins are unique because of the sulphur rich amino acid contents.

- The grains have excellent malting properties and are widely known for its use as weaning foods.

- It has high antioxidant activity.



• Foxtail millet (Kakum)

- It is high in carbohydrates.

- It has double quantity of protein content compared to rice.

- It contains minerals such as copper & iron.



English : Foxtail millet
 Hindi : Kakum
 Bengali : Kaon
 Gujarati : Kang
 Kannada : Navane
 Marathi : Kang, Rala
 Oriya : Kanghu, Kangam, Kora
 Punjabi : Kangni
 Tamil : Tenai, Thinai
 Telugu : Korra

- It provides a host of nutrients, has a sweet nutty flavour and is considered to be one of the most digestible and non-allergic grains.

• **Kodo millets (Kodon)**

- It has high protein content (11%), low fat (4.2%) and very high fibre content (14.3%).

- Kodo millet is rich in B vitamins especially niacin, pyridoxin and folic acid as well as the minerals such as calcium, iron, potassium, magnesium and zinc.

- It contains a high amount of lecithin and is an excellent for strengthening the nervous system.



English : Kodo Millet
Hindi : Kodon
Bengali : Kodo
Gujarati : Kodra
Kannada : Harka
Marathi : Kodra
Oriya : Kodua
Punjabi : Kodra
Tamil : Varagu
Telugu : Arikelu, Arika

• **Barnyard millet (Sanwa)**

- It is the richest source of crude fiber and iron.

- Its grains possess other functional constituents i.e., Gamma amino butyric acid (GABA) and Beta – glucan, used as antioxidants and in reducing blood lipid levels.



English : Barnyard Millet
Hindi : Sanwa
Bengali : Shyama
Gujarati :
Kannada : Oodalu
Marathi : Bhagar
Oriya : Khira
Punjabi : Swank
Tamil : Kuthiraivolly
Telugu : Udalu, Kodisama

• **Little millet (Kutki/ Shavan)**

- It is smaller than other millets.

- It is high in iron content.

- It has high antioxidant activities.

- It contains about 38% of dietary fiber.

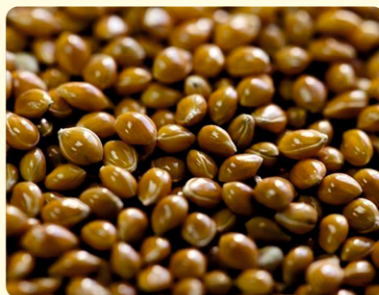


English : Little Millet
Hindi : Kutki, Shavan
Bengali : Sama
Gujarati : Gajro, Kuri
Kannada : Same, Save
Marathi : Sava, Halvi, Vari
Oriya : Suan
Punjabi : Swank
Tamil : Samai
Telugu : Samalu

• **Proso Millet (Chenna/ Barri)**

- It contains the highest amount of proteins (12.5%).

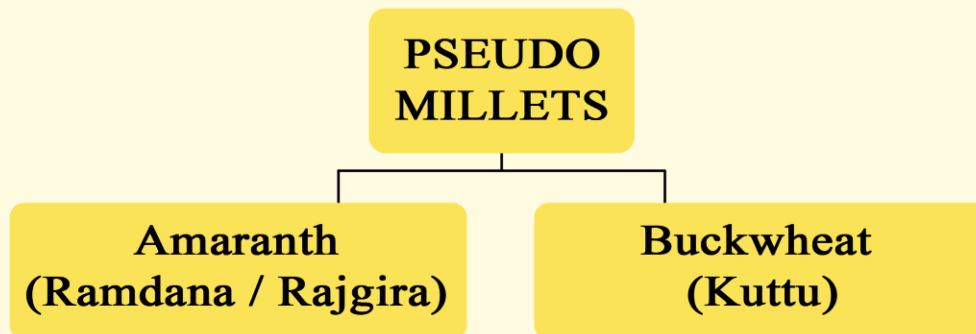
- Health benefits of proso millet come from its unique properties. It has significant amounts of carbohydrate and fatty acids.



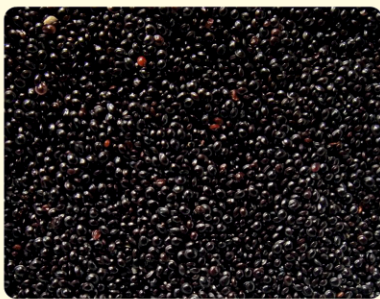
English : Proso Millet
Hindi : Chena, Barri
Bengali : Cheena
Gujarati : Cheno
Kannada : Baragu
Marathi : Vari
Oriya : China Bachari bagmu
Punjabi : Cheena
Tamil : Pani varagu
Telugu : Variga

- It is cheaper source of manganese as compared to other conventional sources like spices and nuts.

- It contains high amounts of calcium which is essential for bone growth and maintenance.
- It reduces cholesterol levels and also reduce the risk of heart diseases.



• Amaranth (Ramdana / Rajgira)



English : Amaranth Seed, black
 Hindi : Ramdana, Rajgira
 Bengali : Amaratba bīja
 Gujarati : Rajgaro
 Kannada : Danthu beeja
 Marathi : Cavali biya
 Oriya : Kosala sag manji
 Dhala
 Punjabi : Chaulai beej
 Tamil : Keerai vidai
 Telugu : Thotakoora ginjalu



English : Amaranth Seed, pale brown
 Hindi : Ramdana, Rajgira
 Bengali : Amaratba bīja
 Gujarati : Rajgaro
 Kannada : Danthu beeja
 Marathi : Cavali biya
 Oriya : Kosala sag manji kale
 Punjabi : Chaulai beej
 Tamil : Keerai vidai
 Telugu : Thotakoora ginjalu

- High protein content (13-14%) and a carrier of lysine, an amino acid that's missing or negligible in many other grains.
- Consists of 6 to 9% of oil which is higher than most other cereals. Amaranth oil contains approximately 77% unsaturated fatty acids and is high in linoleic acid.
- It is high in dietary fibre.
- High in iron, magnesium, phosphorus, potassium and appreciable amounts of calcium.
- A rich dietary source of phytosterols, with cholesterol-lowering properties.
- Contains a lunasin-like peptide and other bioactive peptides which are thought to have cancer-preventive and antihypertensive properties.

• Buckwheat (Kuttu)

- It contains protein 13-15% protein and rich in the amino acid lysine.
- Rich in carbohydrates (mainly starch).
- Contains vitamins B1, C and E.
- Rich in polyunsaturated essential fatty acids, such as linoleic acid.



English : Buckwheat
 Hindi : Kuttu
 Bengali : Bā'ikavāṭa
 Gujarati : Biyām sāthēnō dāṇō
 Kannada : Huruḷi
 Marathi : Baṭaravhīṭa
 Oriya :
 Punjabi : Bā'ikavāṭa
 Tamil :
 Telugu : Bukviṭ

- Contains higher levels of zinc, copper, and manganese than other cereal grains, and the bioavailability of these minerals is also quite high.
- High in soluble fibre.
- A rich source of polyphenol compounds.
- Contains rutin, a bioflavonoid thought to help control blood pressure and possess anti-inflammatory and anti-carcinogenic properties.

III. Comparison on Nutritional Composition of Rice and Wheat with Millets

Millets are rich in terms of their mineral content as compared to wheat and rice. Finger millet proteins are unique because they have abundant sulphur rich amino acids. Millets are extraordinarily superior to rice and wheat in their nutritional composition and therefore is the solution for the malnutrition that affects a vast majority of the Indian population. Millets are viable option to live healthy life and reduce the incidence of lifestyle diseases such as hypertension, cardiovascular disease and diabetes. Millets have many nutritional, nutraceutical and health promoting properties especially the high fibre content.

Following is the Comparative Chart of nutritional value of Millets vis-a-vis Wheat and Rice.

Grains	Carbohydrates (g)	Protein (g)	Fat (g)	Energy (kcal)	Dietary Fiber (g)	Ca (mg)	P (mg)	Mg (mg)	Zn (m)	Fe (mg)	Thia mine (mg)	Ribof lavin (mg)	Niacin (mg)	Folic acid (µg)
Sorghum	67.7	09.9	1.7 3	334	10.2	27.6	274	133	1.9	3.9	0.35	0.14	2.1	39.4
Pearl Millet	61.8	10.9	5.4 3	347	11.5	27.4	289	124	2.7	6.4	0.25	0.20	0.9	36.1
Finger Millet	66.8	07.2	1.9 2	320	11.2	364.0	210	146	2.5	4.6	0.37	0.17	1.3	34.7
Kodo Millet	66.2	08.9	2.5 5	331	06.4	15.3	101	122	1.6	2.3	0.29	0.20	1.5	39.5
Proso Millet*	70.4	12.5	1.1 0	341	-	14.0	2.06	153	1.4	0.8	0.41	0.28	4.5	-
Foxtail Millet*	60.1	12.3	4.3 0	331	-	31.0	188	81	2.4	2.8	0.59	0.11	3.2	15.0
Little Millet	65.5	10.1	3.8 9	346	7.7	16.1	130	91	1.8	1.2	0.26	0.05	1.3	36.2
Barnyard Millet*	65.5	06.2	2.2 0	307	-	20.0	280	82	3.0	5.0	0.33	0.10	4.2	-
Amaranth seed	61	13.3	5.6	356	7.5	162.0	412	270	2.8	8.0	0.04	0.04	0.52	24.7
Wheat	64.7	10.6	1.4 7	321	11.2	39.4	315	125	2.8	3.9	0.46	0.15	2.7	30.1
Rice	78.2	07.9	0.5 2	356	02.8	07.5	96	19	1.2	0.6	0.05	0.05	1.7	9.32

Table - Source: Indian Food Composition Tables, NIN – 2017; *Nutritive value of Indian Foods, NIN – 2007.

Observations on nutritive values of Millets vis-a-vis Wheat and Rice

- ✓ Millets are rich in Calcium. Finger Millet and Amaranth seeds have highest content.
- ✓ Millets are richest source of Phosphorus, Magnesium and Zinc.
- ✓ Amaranth and Pearl millets contain higher Iron content.
- ✓ Millets are good sources of Niacin and Folic acid.
- ✓ Millets are richest source of Dietary fiber as compared to Rice.

IV. Why Millets are Miracle crops?

a) Good for the consumer: they help overcome vitamin and mineral deficiencies such as iron, zinc, folic acid, calcium, diabetes etc.

b) Good for the planet: Most of the millets can be grown on low fertility soils and many of them are also grown to reclaim soils. They do not demand chemical fertilizers and are pest free crops. In fact, under dry land conditions, millets grow better in the absence of chemical fertilizers. Therefore, most millet farmers grow them using farmyard manure under purely eco-friendly conditions. Most millet fields are inherently biodiverse and climate change compliant crops. They are useful in ensuring food safety.

V. Why one should eat millets?

Millets are **gluten-free**, highly nutritious and **rich in dietary fibre**. They are rich in **micronutrients**, including calcium, iron, phosphorus, etc. They are low in Glycemic Index (GI) as such don't cause huge spike in blood sugar. Millets should ideally be an **integral part** of our daily diet.

Dietary fibre in millets has water absorbing and bulking property. It increases transit time of food in the gut which helps in reducing risk of inflammatory bowel disease and acts as detoxifying agent in the body.

VI. What are the Health benefits of Millets?

- ✓ Millets are anti acidic;
- ✓ Millets are gluten free;
- ✓ Helps to prevent type 2 diabetes;
- ✓ Effective in reducing blood pressure;
- ✓ Reduces risk of gastrointestinal conditions like gastric ulcers or colon cancer;
- ✓ Eliminate problems like constipation, excess gas, bloating and cramping;
- ✓ Millet act as a prebiotic feeding microflora in our inner ecosystem.

VII. Facts about Millets:

➤ Can celiac patients consume millets?

Yes. The millets do not contain gluten and therefore, safe for consumption in case of gluten sensitivity.

➤ Are millets healthy for consumption by infants or aged people?

Millets are easy-to-digest and full of nutrients and therefore, ideally suitable for consumption by every age group.

➤ Do millets prevent Cardiovascular disease?

Millet consumption decreases triglycerides and C - reactive protein, thereby preventing cardiovascular disease.

➤ How to cook millets and what recipes can be made from Millets?

Information can be obtained from the following:

'*Millet Recipes - A Healthy Choice* by ICAR- Indian Institute of Millets Research' may be referred.

(https://apeda.gov.in/apedawebsite/miscellaneous/Millets_Recipes_A_Healthy_choice_final.pdf)

VIII. Provisions under FOOD SAFETY AND STANDARDS ACT, 2006

Standards of Sorghum (Jowar) and its flour, Whole and decorticated pearl millet grain (Bajra) and its flour, Finger Millet (Ragi), and Amaranth are prescribed in the sub regulation 2.4 of Food Safety & Standards (Food Product Standards and Food Additives) Regulations, 2011. Further, the standard of Ragi flour is under process of Notification in Gazette of India.

These regulations are available on FSSAI website www.fssai.gov.in

References:

a) Related FSSAI Regulations and Standards

- Food Safety & Standards (Food products Standards and Food Additives), Regulations 2011.
- Quick test for some adulterant in Food: instruction manual part II (Methods for detection of adulterants).

b) Other sources:

- Indian Institute of Millets Research.
- Millet Network of India - Deccan Developed Society – FIAN, India.
- Indian Food Composition Tables, NIN-2017.
- Nutritional and Health Benefits of millets, ICAR – Indian Institute of Millets Research (IIMR).
- Grains and Legumes Nutrition Council.