



Review Article

MILLETS: AYURVEDIC AND MODERN PROSPECTIVE OF UTILIZATION IN CURRENT ERA

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ABSTRACT

Millets are a group of small seeded ancient crops packed with various nutrients, providing health benefits. It is classified under *Kshudra dhanya* in Ayurveda. Food and Agriculture organization and United Nations has announced 2023 as International year of millets and Government of Indian also proposed to celebrate 2023 as International year of millets. **Aim:** To study and analyze the various types of millets and their health benefits, described in various ancient *Samhita*. **Objective:** To study the properties, carbohydrate value and other nutritional value of the various millets. **Material and Methods:** The *Bruhatrayi* & *Laghutrayi*, modern medical textbooks, journals and online database was reviewed for this purpose. **Results & Conclusion:** Millets are good source of protein, fiber, key vitamins & minerals. They are helpful in weight management, preventing various diseases such as obesity, diabetes, cardiovascular disease and inflammation of gut etc.

INTRODUCTION

Millets are one of the ancient crops, consumed by population. Millets are small and mostly round in size and shape, with a variety of color such as white, gray, yellow or red. The millets that we commonly use are Sorghum (jawa), Pearl millet, finger millet (ragi), barnyard millet, proso millet, kodo millet and foxtail millet. Till the recent times millets were considered food of rural India, but due to the raised awareness regarding their health benefits and nutritional value, demand has been increased in urban areas too. Millets are the staple food for the world's poorest and most food insecure people across the semi-arid tropics specially in developing countries. Millets are also one of the major food sources in all over the world. Government is taking many initiatives to promote millets as we now know them as "Anna Shree" for healthy food alternatives^[1]. United Nations declared the Year 2023 as the International Year of Millets^[2] on 5th March 2021, on the proposal moved by Government of India and supported by 72 countries.

Millets are relatively easy to cultivate millets as they are rain fed crop, doesn't require fertilizer, chemicals and attention as the other crops such as wheat and rice do. Millets are cost effective and known as Nutritious cereals. Many vital proteins, vitamins, nutrients, fiber, minerals and other important food components are presents in millets. They are rich in minerals like iron, magnesium, phosphorus and potassium. The glycemic index of millets is also low, which means when we ingest the millets, they release a lower amount of glucose for a longer period of time. This is because millets have high fiber and complex carbohydrates which takes longer to digest and absorb. The Glycemic index of millets^[3] are around 52.7, which is lower value compare to the maize, wheat flour and rice etc. That's why millets are recommended for people with diabetes in their balanced diet. It is important for us as diabetic, pre-diabetic and other metabolic disorders are very rapidly increasing day by day. Millets are gluten free and healthy in celiac disease or gluten allergy or gluten intolerance. Millets are highly nutritious, easy to digest with least allergic properties, which make it healthy for human body compares to other grains. Millets are a good source of Iron, so their consumptions are helpful in Iron deficiency anemia, a disease that is very common in women and children in India. Millets play an important role in management of diabetes mellitus, hyperlipidemia, improve bowel movement, lifestyle disorder and may reduce the incidence of colon cancer.

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In Ayush Dietary Advisory for *Kuposhan Mukta Bharat* there are mention of region-specific millets such as *Aata of Jowar* (sorghum), *Bajra* (pearl millet), *Ragi* (finger millet) *Koni dhan* (tiny rice), *Sava* (Barnyard Millet), *Kodo* (Paspalum) etc. They can help us by breaking the monotony of food items and provide dietary diversification.

In Ayurveda millets are known as *Kshudra Dhanya*, as they are small in size.

Material and methods

The *Bruhatrayi* and *Laghutrayi*, modern medical textbooks, journals and online databases like PubMed, Dhara, Google Scholar etc were reviewed for this purpose.

Types of Millets

- Pearl millet (*Bajara*)
- Finger millet (*Ragi*)
- Sorghum (*jwaaar*)
- Foxtail millet (*Kangni*)
- Proso millet (*Chena*)
- Little millet (*kutki*)
- *Kodo* millet
- Barnyard millet (*Syanva*)
- Foxtail, proso, little, *kodo* and barnyard millets are otherwise known as small millets.

Health Benefits of Millets

- Compared to other cereals millets have a rich micronutrient profile and bioactive flavonoids.

- they are a good source of minerals like iron, zinc, and calcium^[4].
- Millets have a low Glycaemic Index (GI) thus it is helpful in prevention and management of diabetes.
- Millet is rich in antioxidants. Consumption of it, decreases triglycerides and C-reactive protein, thereby preventing cardiovascular disease^[5].
- Millets are helpful in reduction of weight, BMI, and high blood pressure.
- Millets have gluten-free properties^[6] there for it can be consumed by celiac disease (gluten allergy) and IBS^[7] patients.
- Millet is typically complemented with legumes, creating a balanced intake of protein that improves the overall protein digestibility. Convenient and readily available value-added millet products in the ready-to-cook or ready-to-eat categories cater to urban consumers' needs.
- Millet has dual purpose uses as both food and fodder, which enhances farming efficiency. Cultivating millet results in a reduced carbon footprint and improved soil fertility due to its lower water and chemical requirements.
- Millet's versatility enables its use in a variety of dishes, including porridges, salads, and baked goods. Hence, the demand for millet has been steadily rising, domestically and globally, leading to an increase in production and availability.

Table 1: Nutritional composition of millets

Grain	Carbohydrates (g)	Protein (g)	Fat (g)	Energy (g)	Fiber (g)	Ca (mg)	P (mg)	Mg (mg)	Zn (mg)	Fe (mg)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)	folic acid (µg)
Pearl millet	61.8	10.9	5.43	347	11.5	27.4	289	124	2.7	6.4	0.25	0.20	0.9	36.1
Foxtail millet	60.1	12.3	4.30	331	-	31.0	188	81	2.4	2.8	.59	0.11	3.2	15.0
Barnyard millet	65.5	6.2	2.20	307	-	20	280	82	3	5	0.33	0.10	4.2	-
Kodo millet	66.2	8.9	2.55	331	6.4	5.3	101	1221	1.6	2.3	0.29	0.20	1.5	39.5
Proso millet	70.4	12.5	1.10	341	-	14	206	153	1.4	0.8	0.41	0.28	4.5	-
Finger millet	66.8	7.2	1.92	320	11.2	364	210	146	2.5	4.6	0.37	0.17	1.3	34.7
Little millet	65.5	10.1	3.89	347	7.7	16.1	130	91	1.8	1.2	0.26	0.05	1.3	36.2
Sorghum	67.7	9.9	1.73	334	10.2	27.6	274	133	1.9	3.9	0.35	.14	2.1	39.4

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

Millets in Ayurveda^[8]

In Ayurveda millets belong to the group of *Kshudra dhanya* as they are small in size. These are also known as *Trinadhanya* the grains are produced by grass like plants. The millets described in Ayurveda and their properties are given below.

Kangu (Priyangu) - Foxtail millet
Shyamaka - Barnyard millet
Koradusha (Kodrava) - Kodo millet
Cheenaka - Proso millet
Nartaki - Finger millet
Gaveduka - Adlay millet
Yavanaala - Sorghum

The General^[9] and Specific Attributes^[10] of Millets

Millet	English Name	General and Specific attributes
Kangum	Foxtail millet	<i>Guru</i> (heavy in digestion) <i>Sangrahi</i> (absorbs excessive fluids and helps for normal formation of faeces and enhances digestion) <i>Brimghana</i> (nourishment of body tissues) <i>Shoshana</i> (dries up excessive moisture) <i>Bhagna sandhanakari</i> (fracture healing) <i>Vrishya</i> (aphrodisiac)
Yavanaala	Sorghum vulgare	<i>Avrishya</i> (antaphrodisiac), <i>Ruchya</i> (enhances taste perception), <i>Trishghna</i> (pacifies excessive thirst), <i>Kledaghna</i> (pacifies excessive moisture)
Shayamak	Barnyard millet	<i>Shoshana</i> (absorbs excessive fluid), <i>Rukshana</i> (drying), <i>Vatala</i> (increases <i>vata dosha</i>), <i>Kapha pitta hrita</i> (pacifies <i>Kapha- pitta dosha</i>), <i>Sangrahi</i> (absorbs excessive fluids thus helps for normal formation of faeces and enhances digestion), <i>Dhatu shoshaka</i> (dries up the body tissues). Gruel prepared by using <i>Kusha (Desmostachya bipinnata</i> Staff.), <i>Amalaki (Embolica officinalis</i> Gaertn.) and <i>Shyamaka</i> is an effective medication for <i>Rukshana karma</i> (drying)
Gaveduka	Adlay millet	<i>Katu, Madhura Rasa</i> (pungent & sweet in taste) <i>Karshyakarama</i> (emaciating), <i>Kaphahari</i> (pacifies <i>Kapha Dosh</i>), <i>Sangrahi & Dhatu Shoshaka</i>
Cheenaka	Proso millet	<i>Guru</i> (heavy for digestion), <i>Slakshna</i> (smoothness), <i>Durjara</i> (difficult for digestion), <i>Brumhana</i> (nourishes the body tissues), <i>Bhagna-Sandhanakara</i> (promotes fracture healing). The other properties are said to be similar to <i>Kangu</i> (Foxtail millet)
Nartaki	Finger millet	<i>Tikta, Madhura, Kahaya Rasa</i> (bitter, sweet, astringent in taste), <i>Sheeta</i> (cold in potency, anabolic), <i>Snigdha</i> (unctuousness), <i>Balya</i> (promotes strength), <i>Vrishya</i> (aphrodisiac)

DISCUSSION

Clinical significance of Millets

Kangu (Priyangu) Foxtail millet

- Kangu* has *Sangrahi* quality (absorbs excessive fluids and helps for normal formation of faeces and enhances digestion), due to which it can be included in the diet of the patient of *Atisaara* (diarrhea) and *Grahani* (IBS).
- Kangu* has both *Shoshana* (dries up excessive moisture) and *Brimghana* (nourishment of body tissues) properties. It can be included in the diet of *Madhumeha* (diabetes mellitus) and *Sthoulya* (obese) as it absorbs the excessive *Kleda* and over nourished *Dhatu*s, but do not cause any debilitation in the body.
- Kangu* can be used in the diet of a fractured patient as it has *Bhagna sandhanakari* (fracture healing) property.
- It is also *Vrishya* (aphrodisiac), hence stimulates sexual desire.
- Yavanaala* is *Sita virya* and *Trishghna* hence it can be given in excessive thirst.
- It pacifies *Slehsma* and *Pitta dosha*.
- It is also *Ruksha* in nature so it can be given in a patient with excessive unctuousness.
- Shyamaka* can be advised in *Atisara* (diarrhea), *Grahani* (Irritable Bowel Syndrome) due to its *Sangrahi* property.
- Due to its *Shoshana* (dries up excessive moisture), *Rukshna* (reduces unctuousness) property it can be advised in *Sthoulya* (obesity), *Prameha* (diabetes Mellitus), *Medoroga*^[11] (diseases due to excessive lipids).
- It also promotes normal formation of urine.
- It has *Lekhaniya* (scraping) property so it can be indicated in other *Kapha-Pitta Pradhana rogas* such as *Twak Vikara* (skin Diseases) and *Amavata*^[12] (rheumatoid arthritis). Joshi S et al. (2016)
- Shyamaka* has a low glycemic index compared to other grains, which is useful in controlling diabetes mellitus.

- It provides a good amount of energy without increasing fat in the body.

Gaveduka (Coix lachryma jobi - Adlay millet)

Its indications are same as *Syamaka*. It is specifically useful in obesity and obese diabetic (dm) patient, and other *Kpaha prdhana* diseases. The gruel prepared with fried *Gavedhuka* along with honey is mentioned as effective medication for weight loss by Acharya Charak.

Cheenaka (Panicum miliaceum - Proso millet)

- *Cheenak* is *Guru* (heavy), *Ruksha* in *Kapha hara* in nature, so it can be used in *Guru Aptarapana* which is the management described in *Santarpana Janya Vyadhi* (diseases due to over nourishment of body tissues) such as *Sthoulya* (obesity), *Prameha* (diabetes mellitus) and *Medoroga* (dyslipidemia)
- It provides nourishment to the body tissues to its *Brihmghana* property.
- It is advised in diet of the patient of bone fracture due to its *Asthibhagna sandhankari* or fracture healing property.
- Jun DY et al. (2014) reported on pro-apoptotic and anti-adipocytic activities toward adipocytes which is useful in obesity. Shimanuki S et al (2006) reported on the ability of Proso millet in increasing the HDL levels and thus may have strong protective effects against the risk of Coronary Heart Disease development.

Nartaki (Eleusine coracana - Finger millet)

- Due to its *Tikta* (bitter), *Madhura* (sweet), *Kashaya* (astringent) *Rasa* and *Sita virya* (cold in potency) it can be advised in *Raktapitta* (bleeding disorders), *Amlapitta* (gastric disturbances), and *Twak roga* (skin diseases).
- *Snigdha guna yukta* (property of unctuousness), *Durbala* (loss of energy) due to *Balya Karma* (helps to improve energy), *Sthoulya* (obesity) and *Prameha* (diabetes mellitus) as it is *Tikta-Kashaya* (bitter and astringent in taste) and *Balya* (increases strength and energy). Murtaza N et al. (2014) reported on anti-obese property of finger millet and also its role in overcome the oxidative stress induced because of obesity^[13]. Kumari PL et al. (2002) reported the potential action of finger millet against hyperglycemia in Noninsulin dependent diabetes mellitus^[14]. Srivastava K et al. (2012) reported finger millet as a storehouse of nutrients which helps in energy yielding on consumption^[15].
- **The Recipes of Millets Promoted by Ayush Department**
- Millets based foods such as *Ragi idli*, cereal, *Ragi* soup, drinks prepared by *Ragi*, *Sattu*, sorghum based pizza, *Jawar Khichu*, *Kodo millet Khichri*,

millet *Dahi vada*, millet *Dhokla*, *ragi barfi*, millet *Kofta*, *Khakra*, cookies, cake, choco roll etc were prepared by Institute for Teaching and research in Ayurveda (ITRA) Jamnagar in millet expo organized on 18th to 21th march.

- *Ragi* cookies developed in pharmacy of NIA Jaipur.
- Millets based *Poshak* pancakes premix developed under the guidance of ITRA.
- “*Shree Anna se Swasthya Sanrakshan*” a seminar on millets was organized by National institute of ayurveda Jaipur on 6th June 2023. *Raagi chanch*, *raagi malt/finger millet malt*, *Kutki pkkode*, *Bajara roti*, *Bajra churma*, *Jowar raabdi*, *Nartaki chapati*, *Jwara*, *Sava khicdi*, *Sava halva* and various other dishes were prepared there as per Ayurveda.
- According to Ayush Dietary Advisory for *Kuposhan Mukh Bharat*, *Kheer* made of *Ragi* should be given to pregnant women. *Ragi-halwa*, *Nachni halwa* should be given to child between 6 months to 2 years as they prevent malnutrition.

CONCLUSION

Millets are good source of protein, fiber, key vitamins and minerals. They are helpful in weight management, preventing various diseases such as obesity, diabetes, cardiovascular disease and inflammation of gut etc. Millets have historically been seen as less significant grains, little has been done to increase their crop production, their use as significant staple foods, or their processing. As a result, millets are only able to be grown in harsher temperatures and on poorer soils, limiting their ability to reach their full potential. Only the elderly, who can attest to millets' quality, and tribal populations, which include millets in their diet and way of life, consume millets as a staple meal. Even now, millets make up 7% of the average food basket, ensuring the healthiest of the poorest in terms of nutrition and food security. Even cooking ease and preferences were important. Being gluten-free makes it harder to make roti than it would be with wheat. Millets were less favoured over white rice because polished rice tasted better to eat than millets rich in antioxidants and fibre. Millets are typically utilised at the local level to make roti and khichdi. Nowadays, people produce new, creative dishes at home and even on a large scale in hotels and bakeries, such as millet dosa, millet idli, pancakes, millet bread, waffles, crispy crumbs in salad, and cookies. In order to achieve the goal of eradicating hunger, boosting palatability will help in better acceptability by a larger age group.

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