Cloud Publications
International Journal of Advanced Ayurveda, Yoga, Unani, Siddha and Homeopathy
2017, Volume 6, Issue 1, pp. 447-452
ISSN: 2320 – 0251, Crossref: 10.23953/cloud.ijaayush.328

Review Article

Millets: The Indigenous Food Grains

Gyan Chand Kr. Morya, Vinita, Mishra H.S., Shakya S., Raj Bahadur, Yadav K.N.

P.G. Department of Dravyaguna Lalit Hari State, P.G. Ayurveda College & Hospital, Pilibhit, Uttar Pradesh, India

Publication Date: 2 December 2017

DOI: https://doi.org/10.23953/cloud.ijaayush.328

Abstract The present study aims to explore nutritional as well as the therapeutic potential of millets in perspectives of *Ayurveda* substantiated by modern scientific studies. The methodology adopted for the study includes field survey, review of literature starting from ancient Indian classics of *Ayurveda*, modern scientific and research-based publications including journals and periodicals. Millets are still used as supplementary food grains in tribal and relatively lesser developed parts of the country. Millets have been widely used in therapeutics in *Ayurveda* classics. Nutritional potential of millets may be well understood by the following facts- Pearl millet (*Pennisetum typhoides* Burm.f.Stapf. & Habbard) is significantly rich in resistant starch, soluble and insoluble dietary fibers, minerals and antioxidants. It contains 2.8% crude fiber, 7.8% crude fat, 13.6% crude protein, and 63.2% starch. Foxtail millet (*Setaria italica* Linn. Beauv.) is rich in lysine. Finger millet (*Eleusine coracana* Linn.) has carbohydrate 81.5%, protein 9.8%, crude fiber 4.3% and minerals 2.7% which is higher than wheat and rice. Kodo millet (*Paspalum scrobiculatum* Linn.) and little millet (*Panicum miliare* Lam.) also have 37.38% dietary fiber which is highest among cereals. In Proso millet (*Panicum miliaceum* Linn.) protein content found to be 11.6% of dry matter and is greater than wheat protein. Millets have a high nutritive value comparable to major cereal grains. Thus millet proteins are a good source of essential amino acids, micronutrients, phytochemicals, antioxidants, and minerals. The presence of all required nutrients in millets makes them potential dietary supplements.
Keywords *Antioxidants; Dietary supplement; Essential amino acids; Millets*

1. Introduction

Millets are oldest as well as primitive indigenous food grains to be used as staple food. The word “Millet” derived from the latin word “Milium” means small seed (Robert, 2000). Millets are a specific group of plant of Poaceae family containing smaller seed than major cereals (Macdonell and Keith, 1958). They are unique among food grains having smaller size but higher in nutrition. They were first ever introduced in *Rigveda* then in *Yajurveda* and *Atharvaveda* (Bindu, 2010). In Ayurvedic text millets have been referred by the name as *Kudhanya* (Shastri, 2011) and *Trin Dhanya* (Gupta, 2011). These are *Sama* (Echinochloa frumentace Linn.), *Kodo* (Paspalum scrobiculatum Linn.), *Neewar* (Hygroryza aristata Retz.), *Gavedhuk* (Coix lacryma jobi Linn), *Kanguni* (Setaria italica Linn. Beauv.), *Cheena* (Panicum miliaecum Linn.), *Jowar* (Sorghum vulgare Pers.), *Ragi* (Eleusine coracana Linn.), *Bajra* (Pennisetum typhoides Burm.f.Stapf. & Habbard). Millets have been used as food as well as therapeutic diet in *Ayurveda* since *samhita kala*. The one of the best therapeutic indication of these grains is as *Pathya* in various diseases.

1.1. Objective of the Study

The present study aims to explore the nutritional as well as therapeutic potential of millets and advocate their use as future staple food grains for developing countries.

Table 1: *Therapeutic indication of millets in Ayurvedic*

Millet	Botanical Name	Synonyms	Rasa	Guna	Therapeutic uses
Sama (Barnyard Millet)	*Echinochloa frumentace* Linn.	*Shayamak, Shyam, Tribeej, Rajdhanya, Trinbeej, Uttam* (Shastri, 2011)	M, *S*	*Sheet, Snigdh, Laghu*	*Obesity, Raktapitta, Pittaj kasa, Urustambha, Stanyadosa, Jalodara*
Kodo Millet	*Paspalum scrobiculatum* Linn.	*Kodrav, Kordush, Kudyal, Uddalak, Madanagraj*	M, T	*Guru,Ruksha*	*Obesity, Raktapitta, Pittaj kasa,Visha, Urustambha, Trishna, Jalodara, Kustha Stanyadosa, Jalodara*
Gavedhuk (Job's Tear)	*Coix lacryma* jobi Linn.	*Vaijyanti,*	K, M	*Ruksha*	*Obesity, Kapaj Chardi*
Kanguni (foxtail Millet)	*Setaria italica* Linn. Beauv	*Kanguni, Pitatandula, Vatal, Sukumar, Priyangu*	M, S	*Guru, Ruksha*	*Kustha Vatakarak, Pitta-daha nashak, Bhagna-asthi Sandhan*
Cheena (Common Millet)	*Panicum miliaceum* Linn.	*Varak, Sthulkangu, Sthul priyangu, Kangubhed, Marha*	M, S	*Ruksha*	*Brihana*
Jwar (Great Millet)	*Sorghum vulgare* pers.	*Jurnahwa,Yavnal, Raktika Krostupuccha, Sugandhika,*	M	*Guru, Sheet*	*Brihana Malrodhak, Ruchikarak, Viryavardhak, Raktavikar*
Ragi (Finger Millet)	*Eleusine coracana* Linn.	*Madhuli, Ragika, Nartak, Madua*	M, T, S	*Laghu sheet*	*Brihana Triptikarak, Balakarak, Raktapitta shamak*
Bajra (pearl Millet)	*Pennisetum typhoides* Burm.f.Stapf. & Habbard	*Bajranna, Sajak, Nalika, Neelkaran, Agrayadhanya*	M	*Ruksh, Ushna*	*Balya, Agnideepak, Strikamodpadaka, Punsatvahar, Durjara (nighantu ratnakar)*
Neewar	*Hygroryza aristata* Nees.	*Tini, Aranyadhanya, Munidhanya, Trinodbhav*	M	*Laghu, Snigdh, Sheet*	*Raktapitta,Vatarakta, Pathya, Kaphkarak, Malamutra rodhak*

2. Methodology

The methodology adopted for the study includes field survey, literary survey including Ayurvedic literature and research papers related to the topic.

2.1. Nutritive Value of Millets

Nutritional value is the key feature of dietary quality and potential aspect of food grains, because nutrition is responsible for complete physical well being of the society. The richness in dietary fiber, protein, calcium, iron, potassium, zinc, magnesium, vitamins, makes them unique among the cereals. Millets are gluten free, so least allergenic and most digestible grains.

The table shows all the nutritional aspects of millets with respect to major cereals (Ravindran, 1991).

		
Echinochloa frumentace Linn. *(Sanwa)*	*Paspalum scrobiculatum* Linn. *(Kodo)*	Coix lacryma jobi Linn. *(Gavedhuka)*
		
Setaria italica Linn. *Kanguni*	*Panicum miliaceum* Linn. *Cheena*	*Sorghum vulgare* pers. *Jwara*
		
Eleusine coracana Linn. *Ragi (Madua)*	*Pennisetum typhoides* Burm.f.Stapf. & Habbard *(Neewar)*	*Hygroryza aristata* Nees. *(Bajara)*

3. Results and Discussion

Pearl millets is significantly rich in resistant starch, soluble and insoluble dietary fibers, minerals and antioxidants. It contains about 92.5% dry matter, 2.1% ash, 2.8% crude fiber, 7.8% crude fat, 13.6% crude protein and 63.2% starch.

Foxtail millet is used as a supplementary protein source as it is rich in lysine. Finger millet has a carbohydrate content of 81.5%, protein 9.8%, crude fiber 4.3%, and mineral 2.7% that is comparable to other cereals and millets. Its crude fiber and mineral contents are markedly higher than that of wheat (1.2% fiber, 1.5% minerals) and rice (0.2% fiber, 0.6% minerals).

The protein content is relatively better balanced and contains more lysine, threonine, and valine than other millets. Kodo millet and little millet were also reported to have 37% to 38% of dietary fiber, which is the highest among the cereals and has higher polyunsaturated fatty acids. The protein content of Proso millet (11.6% of dry matter) is significantly rich in essential amino acids (leucine, isoleucine, and methionine) than wheat protein. Pearl millet has highest content of micronutrient as iron, zinc, magnesium, phosphorus and vitamins as folic acid and riboflavin. Finger millet is excellent source of calcium and PUFA (Poly unsaturated fatty acids). Barnyard millet contains highest protein

content next to Foxtail millet. All the essential elements of the diet which are responsible for the development of human being are present in millets.

Table 2: *Nutrient composition of millets compared to major cereals (per 100 g)*

Food grains	Carbohydrate(g)	Protein (g)	Fat (g)	Energy (kcal)	Fiber (g)	Mineral (g)	Ca (mg)	P (mg)	Fe (mg)
Finger millet	72.0	7.3	1.3	328	3.6	2.7	344	283	3.9
Kodo millet	65.9	8.3	1.4	309	9.0	2.6	27	188	0.5
Proso millet	70.4	12.5	1.1	341	2.2	1.9	14	206	0.8
Foxtail millet	60.9	12.3	4.3	331	8.0	3.3	31	290	2.8
Little millet	67.0	7.7	4.7	341	7.6	1.5	17	220	9.3
Barnyrd millet	65.5	6.2	2.2	307	9.8	4.4	20	280	5.0
Sorghm	72.6	10.4	1.9	349	1.6	1.6	25	222	4.1
Bajra	67.5	11.6	5.0	361	1.2	2.3	42	296	8.0
Wheat	71.2	11.8	1.5	346	1.2	1.5	41	306	5.3
Rice	78.2	6.8	0.5	345	0.2	0.6	10	160	0.7

Source: Nutritive value of Indian foods, NIN, 2007

Table 3: *Essential amino acid profile of Millets (mg/g of N)*

Grains	Agn	Htd	Lyn	Typ	PhA	Tyn	Mth	Cyn	Thy	Luc	Ilc	Vln
Foxtail	220	130	140	60	420	-	180	100	190	1040	480	430
Proso	290	110	190	50	310	-	160	-	150	760	410	410
Finger	300	130	220	100	310	220	210	140	240	690	400	480
Little	250	120	110	60	330	-	180	90	190	760	370	350
Barnyard	270	120	150	50	430	-	180	110	200	650	360	410
Sorghum	240	160	150	70	300	180	100	90	210	880	270	340
Bajra	300	140	190	110	290	200	150	110	140	750	260	330
Rice	480	130	230	80	280	290	150	90	230	500	300	380
Wheat	290	130	170	70	280	180	90	140	180	410	220	280

Source: Nutritive value of Indian foods, NIN, 2007

Agn-Argenine, Htd-Histidine, Lyn-Lysine, Typ-Tryptophan, PhA-Phenyl Alanine, Tyn-Tyrosine, Mth-Methionine, Cyn-Cytosine, Thy-Thyrosine, Luc-Lucine, Ilc-Isolucine, Vln-Valine

Table 4: *Fatty acid composition of millets*

Millet	Palmitic	Palmoleic	Stearic	Oleic	Linoleic	Linolenic
Foxtail	6.40	-	6.30	13.0	66.50	-
Proso	-	10.80	-	53.80	34.90	-
Finger	-	-	-	-	-	-
Little	-	-	-	-	-	-
Sorghum	14.0	-	2.10	31.0	49.0	2.70
Bajra	20.85	-	-	25.40	46.0	4.10
Rice	15.0	-	1.90	42.50	39.10	1.10
Wheat	24.50	0.80	1.00	11.50	56.30	3.70

Source: Nutritive value of Indian foods, NIN, 2007

In Ayurvedic texts all the millets are specially indicated as *Pathya* in many diseased conditions since primitive time. *C. lacryma* has been said to be best for losing fat and obesity. *P. scrobiculatum* and *E. frumentace* used for Obesity, *Raktapitta, Pittaja Kasa, Visha, Urustambha, Trishna, Kustha, Stanyadosa, Jalodara*. *E. coracana* used for *Brihana Triptikarak, Balaya, Raktapitta shamak. P. typhoides used for Balya, Agnidepak, Strikamodpadaka*.

Table 5: *Amylose and amylopectin content of millets*

Food grain	Amylose (%)	Amylopectin (%)
Proso millet	28.2	71.8
Foxtail millet	17.5	82.5
Kodo millet	24.0	76.0
Finger millet	16.0	84.0
Sorghum	24.0	76.0
Bajra	21.1	78.9
Rice	12-19	88-81
Wheat	25.0	75.0

Source: MILLET in your Meals, Available from: http://www.sahajasamrudha.org

Table 6: *Micronutrient profile of Millets (mg/100g)*

Millets	Mg	Na	K	Cu	Mn	Mb	Zn	Cr	Su	Cl
Foxtail	81	4.6	250	1.40	0.60	0.070	2.4	0.030	171	37
Proso	153	8.2	113	1.60	0.60	-	1.4	0.020	157	19
Finger	137	11.0	408	0.47	5.49	0.102	2.3	0.028	160	44
Little	133	8.1	129	1.00	0.68	0.016	3.7	0.180	149	13
Barnyard	82	-	-	0.60	0.96	-	3	0.090	-	-
Kodo	147	4.6	144	1.60	1.10	-	0.7	0.020	136	11
Sorghum	171	7.3	131	0.46	0.78	0.039	1.6	0.008	54	44
Bajra	137	10.9	307	1.06	1.15	0.069	3.1	0.023	147	39
Rice	90	-	-	0.14	0.59	0.058	1.4	0.004	-	-
Wheat	138	17.1	284	0.68	2.29	0.051	2.7	0.012	128	47

Source: Nutritive value of Indian foods, NIN, 2007

Table 7: Vitamin profile of Millets (mg/100g)

Millet	Vit.B_1	Vit.B_3	Vit.B_2	Vit.A	Vit.B_6	Folic Acid	Vit.B_5	Vit.E
Foxtail	0.59	3.2	0.11	32	-	15.0	0.82	31.0
Proso	0.41	4.5	0.28	0	-	-	1.2	-
Finger	0.42	1.1	0.19	42	-	18.3	-	22.0
Little	0.3	3.2	0.09	0	-	9.0	-	-
Barnyard	0.33	4.2	0.1	0	-	-	-	-
Kodo	0.15	2.0	0.09	0	-	23.1	-	-
Sorghum	0.38	4.3	0.15	47	0.21	20.0	1.25	12.0
Bajra	0.38	2.8	0.21	132	-	45.5	1.09	19.0
Rice	0.41	4.3	0.04	0	-	8.0	-	-
Wheat	0.41	5.1	0.1	64	0.57	36.6	-	-

Source: Nutritive value of Indian foods, NIN, 2007

4. Conclusion

Ayurvedic literature reflects that millets (minor grains) have been used as a dietary supplement as well as therapeutic agent for long time. Overall nutritional superiority of millets equips them with nutritional and neutraceutical potential. These grains are ignored by society because of inclination towards rice and wheat. Our society is suffering from malnutrition and other dietary insufficiencies. So, we have to change the food habits. It is the only way to conserve the indigenous food grains of India.

References

Robert, F. 2000. The words of Medicine. *Charles C Thomas Publisher Ltd.*, Springfield, USA, p.121.

Macdonell, A.A. and Keith, A.B. 1958. Vedic Index of Names and Subjects, Motilal Banarasi Das, Delhi, India, p.208, 385, 418, 441.

Bindu, S. 2010. Medicinal plants in Vedas, Chaukhamba Vishwabharti, Varanasi, p.35, 48, 71, 78, 81, 91, 93.

Shastri, A.D. 2011. Sushruta Samhita of Sharira, Ayurveda Tatava Sandipika Commentary, Chaukhamba Sanskrit Sansthan, Varanasi, India.

Gupta, K.A. 2011. Ashtang Hridaya of Vagbhat, Vidyotini Hindi Commentary, Chaukhambha Prakashan Varanasi Sutra Sthana.

Chuneker, K.C. 2013. Bhava Prakash Nignantu of Bhav Mishra. Hindi Commentary Chaukhambha Bharti Academy, Varanasi, Uttar Pradesh, India.

Pandey, K.N. and Chaturvedi, G.N. 2009. Charak Samhita of Agnivesh, Vidyotani Hindi Commentary, Chaukhamba Bharati Academy, Varanasi, India.

Shastri, A.D. 2011. Sushruta Samhita of Sharira, Ayurveda Tatava Sandipika Commentary, Chaukhamba Sanskrit Sansthan, Varanasi, India, 1(9), p.248.

Ravindran, G. 1991. Studies on millets: proximate composition, mineral composition, phytate and oxalate content. *Food Chem.*, 39(1), pp.99-107.