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Nutritional Aspects & Health Benefits of Millets

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Introduction

Millets are a highly varied group of small-seeded grasses widely grown around the world a serial crops or grain for fodder and human food. Millets grains have been discovered in post used for storing grans and seeds discovered at archaeological sites in present in day china ,India , Europe and different parts of Africa. Assam (18.82kg/hsh/m) and Bihar (18.69kg/hsh/m) states have highest consumption of small Millets found it all India and rural areas. Madhya Pradesh has highest area of small Millets (32.4%) followed by Chhattisgarh (19.5%) , Uttarakhand (8%) , Maharashtra (7.8%) , Gujarat (5.3%) and Tamil Nadu (3.9%) . Millets have been a good part of the staple diet among many communities across the world . Most species generally referred to as millet belong to the tribe paniceae but somemillet also being to other taxa. millet are known for their potential health benefits which includes anti diabeticproperties and low glycemic index in millet based food product which may be helpful in reducing the postpaidglucose level and glycosylated hemoglobin.milet also have antioxidant and antimicrobial properties andprotein content of Pearl millet. Ingeneral Millets are rich in source of fiber, minerals and B – complexvitamins. Millet are non – acid formingandeasytodigestandnon –allergenic.Millets also formed important parts of the prehistoric dict in Indian, Chinese, Neolithic and Korean Mumun societies. India is the largest producer of millet, followed by Niger and China. Other major millet producing countries include Burkina Faso ,Mali and Senegal.

Types of Millets

- **Pearl millet (*Pennisetum glaucum*)** – pearl millet originated in Central tropical Africa and is widely distributed in the drier tropics and India. it was introduced into the Western state in the 1850's and become established as minor forage in the Southeast and Gulf coast States. the plant was probably domesticated as a food crop some 4000 to 5000 years ago along the southern margins of the central Highlands of the sahara.

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- **Finger millet (*Eleusine coracana*)** - finger millet is a serial grass grown mostly for its grain finger millet is a robust tufted during annual grass . up to 170 cm high (FAO ,2012 ,De Wet ,2006 ,Quattrocchi ,2006). The inflorescence is a panicle with 4-19 finger- like spikes that resembles a first when mature, hence the name finger millet.
- **Proso millet (*Panicum miliaceum*)** – proso millet is a annual grass, growing form each year is origin goes back in history at least as far as 2000 B..C. when it is reported to have been grown in the central reason of Europe this plant is especially well suited to dry climate such as Central Russia, the Middle East Northern India, Africa Manchuria and the great planes area of North America . Proso millet was first introduced to Canada in the 17th century and was used in a limited way as a forage crop in the early 1900's.
- **Foxtail millet (*Setaria italica*)** – Foxtail millet is regarded as a native of China, it is one of the world's oldest cultivated crops foxtail millet ranks second in the total world production of millet and continue to have an important place in the world agriculture providing approximately 6 million tons of food too million of people mainly on poor or marginal soils in southern Europe and in temperate , Sub tropical and tropical Asia.
- **Little millet (*Panicum sumartrence*)** – little millet was domesticated in India. it grown throughout India to a limited extent up to altitude of 2100 m, but is of little importance elsewhere. the seeds of little millets are smaller than those of common millet .these species of serial is similar in habit to the proso millet axcept that it is smaller.

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Nutritional Importance of Millets

Millets and sorghum namely,pearl millet (*Pennisetum glaucum*), Finger millet (*Eleusine coracana),* Kodo millet (*Paspalumscrobiculatum*) , proso millet (*Panicum miliaceum*) , Foxtail millet (*Setaria italica*) , little millet (*Panicum sumartrence*)and Barnyard millet (*Echinochloa crusgalli*) are important staples to million of people world-wide . Generally,these arerain fed crops grown in areas with low rainfall and thus resume greater importance for sustained Agriculture and foodsecurity. Almost all the millets are used for humans consumption in most of the developing countries but their use hasbeen primarily restricted inanimal feed in developed countries. Millets are nutritionally comparable to major cerealsand serve as good source of protein, micronutrients and phytochemicals. Processing methods like soaking, malting,decortication,andcooking affect theanti-oxidant contentandactivity .

Nutritional Characteristics

- **Carbohydrates-** The carbohydrate content in sorghum composed of starch, soluble sugar and fibre (pentasons cellulose and hemislelu's)millet carbohydrates classified non- structural sugars starch and fructosans) and structural (cellulose hemi cellulosis andpactinsubstances)carbohydrates thechiefnon structuralcarbohydrate (NSC)isstarch**.**
- **Starch -** Form one half to three – fourth of the grain wait is starch starchesexist in a highly organised manner in which amy laysandamylopectinmoleculesareheldtogetherbyhydrogenbonds andarrangedradicallyandsphericalgranulesstarchisthemainsourceofenergyutilisedduring germinationitiscomposedoflinearchainsofglucosejoinedbyalphaone4-glycoside it wants called amylopectin is a much larger branched polymer. the pigment of millet grain pericarpsometimesdiscolorethestarch, yielding alight pinkcolour ,greenandyellowcolour.
- **Soluble sugar-** The soluble sugar content of caryopsis process changes during development and is maximum 5.2% at maturity the average soluble sugar content was 1.3% with sucrose being 75% of the sugar contain mature caryopsis 2.2 to 3.8 percent soluble sugars 0.9 to 2.5% free reducing sugar and 1.3-1.4% non reducing sugar glucose and fructose d from 0.6 to 1.8% and 0.3 to 0.7% respectively.

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- **Dietary fibre-** The dietary fibre contain of several Indian foods have been determined dietary fibre components accept they are beneficial effects mostly by way of their swelling properties and buy increasing transit time in the small intestine the increase in transit time reflects reduce the rate of release of glucose and its absorption those helping in the management of certain types of diabeties.
- **Fatty acids -** Lipids are Relatively minor constitutes in millets .most of the lipids are located in the scutellar area of the germ . Thus lipid content is significantly reduced when the germs removed during the decortication or the germination .the typical fatty acid composition of Sorghum lipid as similar to that of maize oil (wall & Blessin) 1970 . The lipids can be subdivided into polar nonpolar and nonsaponifiable lipids the most abundant by far are the nonpolar lipids 72- 80% the composition of the nonpolar lipids was clearly dominated by triglyceride 85%, followed by sterols 4.1% diglycerides 4.0% triglycerides Serve as a reserve material for germination.
- **Protein-** Protein content & consumption very due to agronomic condition (water availability, soil fertility, temperature and environment condition during green development) and genotype. millet protein are located in the endosperm 80%, germ 16% and paricarp 3%.All amino acids in the fractions increased as total protein in the fractions increased. However, relative distribution of amino acids in the protein varied as protein content of the sample changed; consequently, protein efficiencies should differ from one fraction to another. Percentages of lysine, cystine, methionine, threonine, and tryptophan of the protein decreased as protein content of the endosperm fractions increased. In fraction3 the percentages of valine, isoleucine, leucine, and phenylalanine in the protein were less than those found in the higher-protein fraction.

Nutrition Composition of Millets per 100g of edible portion

Parameter	Protein (g)	Fat (g)	Minerals (g)	Total dietary fiber (g)	Insoluble dietary fiber (g)	Soluble dietary fiber (g)	CHO (g)
Finger	7.20	1.90	2.00	11.20	9.50	1.70	66.80
Proso	12.50	1.10	1.90	-	-	-	70.40

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Foxtail	12.30	4.30	3.30	-	-	-	60.90
Little	10.40	3.90	1.30	7.70	5.50	2.30	65.60
Kodo	8.90	2.60	1.70	6.40	4.30	2.10	66.20
Barnyard	6.20	4.40	2.20	-	-	-	65.50
Brown Top Millet	11.5	-	4.2	12.5	-	-	-
Pearl	11.0	5.40	1.40	11.50	9.10	2.30	61.80
Sorghum	10.00	1.70	1.40	10.20	8.50	1.70	67.70
***Source: Indian food consumption table 2017, NIN 2007, IIMR**							

Vitamins and Mineral composition of millet mg per 100 g of edible portion

Parameter	**Finger**	**Proso**	**Foxtail**	**Little**	**Kodo**	**Barnyard**	**Pearl**	**Sorghum**
Vitamins								
Total Carotenoids	154	-	32	120	272	-	293	212
Thiamine	0.37	0.20	0.59	0.26	0.29	0.33	0.33	0.35
Riboflavin	0.17	0.18	0.11	0.05	0.20	0.10	0.25	0.14
Niacin	1.34	2.3	3.2	1.29	1.49	4.2	2.3	2.1
Minerals								
Calcium	364	14	31	16.06	15.27	20	42	27.6
Phosphorus	283	206	290	220	188	280	296	274
Iron	4.62	0.8	2.8	1.26	2.34	5.0	8.0	3.95
Magnesium	137	153	81	133	147	82	137	1.33
Sodium	11	8.2	4.6	8.1	4.6	-	10.9	5.42
Potassium	408	113	25	129	144	-	307	328
Copper	0.67	1.60	1.40	0.34	0.26	0.60	1.06	0.45
Zinc	2.3	1.4	2.4	3.7	0.7	0.3	3.1	1.96
***Source:- IFCT 2017 & NIN 2007 .**								

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Health Benefits of Millets

Millet grains based on literature values are known to be rich in phenolic acids, tannins, and phytate (Thompson, 1993). These nutrients reduce the risk for colon and breast cancer in animals (Graf and Eaton, 1990). The fiber present in sorghum And millet and also the phenolic have been attributed for lower incidence of esophageal cancer than those consuming wheat Or maize (Van Rensburg, 1981). Recent research has revealed that fiber as one of the best and easiest ways to prevent the Onset of breast cancer in women. They can reduce their chances of breast cancer by more than 50% by eating more than 30 gm of fiber every day.

Many of the antioxidants found in millet have beneficial impact on neutralizing the free radicals, which can cause cancer And clean up other toxins from body such as those in kidney and liver. Quercetin, cucurmin, ellagic acid and various other Beneficial catechins can help to clear the system on any foreign agents and toxins by promoting proper excretion and Neutralizing enzymatic activity in those organs. Therefore, tremendous attention has been given to polyphenol due to their roles in humans health.The antioxidant, metal chelating and reducing powers are shown by the soluble and insoluble bound phenolic extracts of Several varieties of millet (kodo, finger, foxtail, proso, pearl and little millets) (Chandrasekara and Shahidi, 2010). Foxtail Millet contains 47mg polyphenolics/100 g and 3.34 mg tocopherol/100 g (wet basis); however, proso millet contains 29Mg polyphenolics/100 g and 2.22 mg tocopherol/100 g (wet basis). In addition, a positive and significant correlation ($R2=0.9973$, $P<0.01$) between polyphenolic content and radical cation scavenging activity was observed.

Properties of Dietary fiber and their health consequences

Function	Health Consequences	Millet
Water absorbing and bulking property	Energy diluents to formulate low calories diet	All Millets
Increased transit time of food in gut	Reduced risk of inflammatory bowel disease	Sorghum and finger millet.
Bile acid and steroid binding	Hypercholesterolemiaactivity and reducing the risk of cardiovascular disease	Pearl millet, Sorghum and finger millet.
Retardation of carbohydrate	Management of certain type of	Pearl millet, Sorghum and

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absorption and impaired glucose tolerance	diabetes	finger millet.
Binding of toxins	As a detoxifying agent	Sorghum
Binding of divalent cations	Reduced bioavailability of Ca, Mg, Zn, Fe.	Proso Millet and Fox Tail Millet (Unprocessed)

- Millets are rich yours of phytochemicals such as phenolic ligennsn beta-glucent inulin, resistant starch , sterols,phytes,tocopherols ,diatory fibre and carotinoid are present. Mainly polyphenol and phenolic acids Tannins small qualitiesflavonoidsactsasAntioxidantsandplayaroleinmaintainingbodyimmunesystemp romotsbetterhealthandwellbeingthus helping to reduce the risk of chronic disease such as obesity,Diabetes cardiovascular disease, cancer asthmaetc.Millets have potential health benefits and epidemiological studies have showed that consumption of millets reducesrisk of Heart disease, protects from diabetes, improves digestive system, lowers the risk of cancer, detoxifies the body,increases Immunity in respiratory health, increases energy levels and improves muscular and neural systems and areprotective Against several degenerative diseases such as metabolic syndrome and Parkinson's disease (Manach et al.,2005;Scalbertetal.,2005; ChandrasekaraandShahidi, 2012).
- Specially ragi contains an amino acid called Tryptophan, which lowers appetite and helps in keeping weight in control
- Ragi is digested at a slower rate thus keep one away from intake of excessive calories. Also , fiber present in ragi give a feeling in fullness thus controls excessive food consumption.

Conclusion

Pearl millet is grown largely for its ability to produce grain under hot, dry conditions on infertile soils of low water-holding capacity, where other crops generally fail completely. Correspondingly, it is produced mainly in outlying areas peripheral to the major production and population centres of the developing world. Yields are low, averaging only three-quarters of sorghum yields in Africa and Asia. Most farmers who rely on this crop are quite poor and frequently experience food shortfalls. Little of the millet production enters the commercial

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market; most never leaves the farm on which it is grown. Rather, many millet farmers are more likely to be food buyers than sellers. The combination of poverty and severe environmental conditions makes it difficult to improve productivity in pearl millet. While yields are growing in Asia, many African producers are unable to raise yields because of the Continuing expansion into even drier and harsher agroecologies and poor adoption of "improved" technologies in these environments. A major reason for poor adoption is that some of these technologies are expensive or otherwise inappropriate for these harsh environments.

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