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Nutritional and health benefits of Millets: A review

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Abstract

In present scenario so many lifestyle diseases like heart disease, obesity, diabetes, stroke, hypertension, asthma, osteoporosis etc. are prevalent today across all sections of society and Millets which are climate resilient, hardy and dry land crops also termed as Nutri cereals can contribute substantially for food and nutritional security. Millets are still main food for millions of poor population in Africa and Asia.

Millets are considered to be healthier than other cereals and serve as good source of protein, micronutrients and phyto - chemicals. The millets contain 7-12% protein, 2-5% fat, 65-75% carbohydrates and 15-20% dietary fibre. Millets are found to be very suitable for consumption for people living with diabetes, cancer, blood pressure, heart disease, Celiac diseases, osteoporosis etc. In this review significance of different types of millets and their health benefits has been discussed in detail.

Keywords: Millets, nutritional value, diabetes, cancer, hypertension, osteoporosis etc.

Introduction

Millet is a type of grass (Poaceae) which is grown as a cereal crop for human consumption and fodder. The most commonly cultivated millets include Ragi (Finger millet/*Eleusine coracana*), Bajra (Pearl millet/*Pennisetum glaucum*), little millet (*Panicum sumatrense*), kodo millet (*Paspalum scrobiculatum*) and great millet (*Sorghum/Sorghum bicolor*). Since centuries, the millets have provided food and nutritional security to the populations in the disadvantaged geographical regions. Due to its highly productive and short growing season it can be cultivated in dry, high temperature conditions, semi arid, less fertile and poor soil regions. In India commonly grown millets are little millet and kodo millet. The Food & Agriculture organisation of the UN has declared 2023 as International year of millets. Millets are climate resilient crops and can adapt to wide ranges of climatic conditions. They can be grown in marginal soil conditions with minimal requirement for irrigation water.

Millet is termed as “miracle grain” or “crop of the future” because cultivation of millet is very sustainable as it requires much fewer resources compared to other crops. An equal number of rice plants require 2.5 times more water than millet and can be grown along with other crops like pulses, vegetables and oil seeds. Millet also helps in reducing atmospheric carbon dioxide. They are rich in iron, copper, manganese, calcium, phosphorous, magnesium and vitamin B. They also contain anti oxidants, flavonoids, amino acids and tryptophan. India is the highest producer of millet in the world and produced 41% in 2020.

Nutritional Content in Millets

Table 1: Comparison of nutritional content in 100 grams of dry grains (cereals).

Sl.no	Millet	Iron (in mg)	Calcium (in mg)	Minerals (in gms)	Fibre (in gms)	Protein (in gms)
1.	Pearl millet	11	42	2.2	2.3	11.8
2.	Finger millet	3.9	344	2.7	3.6	7.3
3.	Fox tail millet	2.8	31	4	6.7	12.3
4.	Kodo millet	1.7	35	2.6	5.2	8.3
5.	Little millet	9.3	17	1.7	7.6	7.7
6.	Sorghum millet	5.4	25	1.2	2	10.4
7.	Rice	1.8	33	0.6	1	6.8
8.	Wheat	3.5	30	1.5	2	11.8

Source: National Institute for Nutrition, Hyderabad.

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Nutritional Benefits of Millets

Various types of millets are cultivated along with other crops in India. They are very nutritious and have many benefits for human health. Finger millet or ragi is the most common millet consumed in Indian homes. Ragi is gluten free and is rich in fibre which helps in digestion. It is also a good source of protein, iron, calcium and anti oxidants. Fox tail millets also known as Kangni is consumed as a whole grain and flour. It is very rich in protein, iron, calcium etc. Pearl millet or bajra is

gluten free and rich in protein, iron, calcium and fibre. Sorghum millet or jowar is a rich source of protein, fibre, magnesium. Millets also help in weight loss, reduces risk of colon cancer, decreases high BP, helps in slowing muscle degradation, helps in sleep, helps in relieving, menstrual cramps. Studies by Eunyoung Lee *et al.*, 2023 [5] suggest that millets seed oil activates beta cartenin signalling and promotes hair growth which is beneficial for preventing or to treat androgen etic alopecia by promoting hair growth.

Table 2: Types of Millets and health benefits

Types of millets	Health Benefits
Finger millet	Inhibit cataract eye lens, Lower plasma glucose level, Antimicrobial activity against <i>Bacillus cereus</i> and <i>Aspergillus flavus</i>
Foxtail millet	Anti hyperglycemic activity
Proso millet	Improved HDL, Lower triglycerides, Prevent cardiovascular disease
Kodo millet	Inhibit glycation and cross linking of collagen leads to inhibition of aging
Pearl millets	Inhibiting the growth of the phytopathogenic fungi
Barnyard millets	Improved the levels of HDL
Little millet	Inhibitory effects on lipid peroxidation

Source: Verma *et al.*, (2012); Fereidoon Shahidi *et al.*, (2013) [26]

Health Benefits of Millets

Millets contain many different nutrients, chemicals which are useful for our health when consumed as a part of the diet. Millets are hidden source for health promoting phytochemicals, and antioxidant as nutraceuticals as well as functional food (Himanshu *et al.*, 2018) [9]. Some of the important benefits of millets are briefly described as below:

- 1. Control of diabetes:** Diabetes is a chronic disease that occurs either when the pancreas does not produce enough insulin or when the body cannot effectively use the insulin it produces. Diabetes is a long-term metabolic disease which identify by hyperglycemia (high blood sugar level) related with conversion of protein, lipid and carbohydrates metabolism. Finger millet-based foods have been conveyed to having low glycemic index because of rich in fiber and also alpha amylase prohibition qualities that is studied to reduction of polymeric carbohydrates digestion and absorption (Kumari and Sumathi, 2002) [13]. Millets also help in controlling sugar level in blood and dermal wound healing process (Rajesh Keran N S *et al.*, 2004) [19]. Studies conducted by Pradhan *et al.*, 2010 [18] showed that persons, who have taken millet in diet, had decreased level of blood glucose. The whole grains foods are considered to be effective for the prevention and management of diabetes mellitus, and showed that population who take millet have epidemiologically lower levels of diabetes (American Diabetes Association 2005; Shobana *et al.*, 2013; Kim *et al.*, 2011) [5, 27, 11]. Millets have a significant amount of Magnesium which helps in increasing the efficiency of Insulin and glucose receptors by producing many carbohydrate digesting enzymes, which manages insulin action. (O.S.K. Reddy, 2017) [16]. Millets have ability to reduce glucose by enzymatic hydrolysis of complex carbohydrate in hyperglycemia. The aldose reductase enzyme helps in preventing accumulation of sorbitol and decrease the risk of diabetes.
- 2. Reduction in cancer:** Studies have shown that the Millets are rich in antinutrients such as polyphenols, tannins and phytic acid which help in reducing the risk of cancer. Chandrasekara and Shahidi 2011 reported that

Phenolics are effective for the prevention of the cancer initiation and progression. Foxtail Millet bran derived peroxidase has a therapeutic potential in the management of colon cancer (Shuhua Shan *et al.*, 2015) [28]. Sorgam has anticarcinogenic properties and antimutagenic property has been found in Sorghum due to presence of tannins and polyphenols (Grimmer *et al.*, 1992) [6]. Quercetin, curcumin, ellagic acid, and various other beneficial catechins found in millets can help to rid any foreign agents and toxins in our body by promoting proper excretion and neutralizing enzymatic activity in those organs. (O.S.K. Reddy, 2017) [16].

- 3. Reducing heart disease:** Millets being a good source of magnesium helps in reducing heart attack. Millets are rich in phyto-chemicals which help in lowering cholesterol and prevent cardio vascular disease (Lee *et al.*, 2010) [14]. Millets have a good source of protein and essential amino acid, micronutrient and phytochemicals. It plays significant role as health promoter and also help in preventing diabetes, hyperlipidemia, etc. (Veena, 2003) [32]. Consumption of millets reduces hyperlipidemia and hence hypertension and raises the levels of HDL-C (good Cholesterol) which can be beneficial for managing the risk associated with developing hypertension and atherosclerotic cardiovascular disease in future (Anitha *et al.*, 2021) [24].
- 4. Prevention of Celiac disease:** Celiac disease is a hereditary disease which leads the people to suffer a reaction with gluten proteins such as glutenin and gliadin that are found in wheat and other crops. A gluten free diet primarily plays a major role in affecting food consumption in the grain food group. It is an autoimmune genetic disorders associated with consumption of gluten commonly found in cereals like wheat, rye and barley. Millets are gluten free which help to decrease irritation of other cereal grains (Saleh *et al.*, 2013) [21]. Replacing cereals like wheat, barley, rye-based foods made from gluten free grains, including millet, amaranth, buck wheat, quinoa, and wild rice may help people adhering to gluten free diet (Thompson, 2009) [30]. Millets are gluten-free and foods and beverages made from millets can be suitable for celiac disease person (Taylor and

Emmambux 2008; Chandrasekara and Shahidi 2011) [29, 3].

- 5. Antioxidants:** Various studies suggest that Millets, are good source of phytochemicals and micronutrients. Phytochemicals like phenolics, sterols, lignans, inulin, resistant starch, β -glucan, phytates, tocopherol, dietary fiber and carotenoids. Dietary plant polyphenols have received tremendous attention from health professionals, nutrition scientists and consumers for their pleotropic health benefits like neuro-degenerative diseases, infections, aging, diabetes, reduced risk of cancer and cardiovascular disease (Kaur and Kapoor, 2001; Scalbert *et al.*, 2005; Tsao, 2010) [10, 23, 31]. In finger millet grains proto-catechuic acid (45.0 mg/100 g) is found as the major free phenolic acid (Rao and Muralikrishna, 2002) [20]. Finger millet can also inhibit collagen cross-linking (Hegde *et al.*, 2002) [7], which can be used to slow down aging by reducing the stiffness of elastic tissues in tendons, skin and blood vessels. Soluble and insoluble bound phenolic extracts of several varieties of millet (kodo, finger, foxtail, proso, pearl and little millets) have shown antioxidant, metal chelating and reducing powers (Chandrasekara and Shahidi, 2010) [2]. Barnyard millet grains possess other functional constituents' viz. γ -amino butyric acid (GABA) and β -glucan, used as antioxidants and in reducing blood lipid levels. The seed coat of Finger millet grains, contain high amount of various phenolic compounds and have been reported to exhibit antioxidant activity (Rao and Muralikrishna, 2002; Hegde *et al.*, 2005; Chandrasekara and Shahidi, 2010) [20, 8, 2]. 0.04–0.09% and 0.08–3.47% polyphenols content is found in white finger millet and brown varieties (Chethan and Malleshi, 2007) [4]. Phenolic acids, tannins and flavonoids present in millet acts as antioxidant and play a role in the body immune system (Chandrasekara and Shahidi, 2010) [2].
- 6. Prevention of Osteoporosis:** Osteoporosis is a bone disease that develops when bone mineral density and bone mass decreases, or when the structure and strength of bone changes. Intake of high dietary naturally available calcium helps in prevention of bone diseases like osteoporosis. Finger millet is a good source of calcium with up to 350 mg/100 g of Calcium present in the seeds, which is 5–10 times higher than other cereals (Panwar *et al.*, 2010; Sanwalka *et al.*, 2011; Kumar *et al.*, 2013) [17, 22, 12]. Therefore, consumption of products derived from finger millet can be utilized in bone mass development in growing children as well as for preventing osteoporosis and other bone ailments in adults and aging population.

Conclusion

All the lifestyle diseases can be made to disappear just by eating millets for breakfast, lunch and dinner and removing refined foods like rice, wheat, refined flours, processed meats, refined oils, packed & ready to consume -kind of foods and milk. Most of the people still have not even heard about millets and much less understand the benefits of millet nutrition. All the millets have different nutritive values, however as whole Millets are rich source of minerals like Ca, Mg and K and reported to have numerous health benefits such as maintaining blood sugar level, blood pressure and cholesterol levels. They are easy to digest due to high fiber

content and it contains high lecithin which is great for building up the nervous system. Millets are gluten free and can be great choice for people who have for celiac disease or follow gluten free diet. Regular consumption of millets can give a healthy life especially for those who have diabetes, Blood pressure, Celiac disease, cancer etc.

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