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INDIAN MILLETS: HEALTH-PROMOTING NUTRITIOUS CROPS

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ABSTRACT

Indian millets are a group of nutritiously rich, drought tolerant and mostly grown in the arid and semi-arid regions of India. They are small-seeded grasses belonging to the botanical family Poaceae. They constitute an important source of food and fodder for millions of resource-poor farmers and play a vital role in ecological and economic security of India. Indian Millets are nutritionally superior to wheat and rice as they are rich in protein, vitamins and minerals. They are also gluten-free and have a low glycemic index, making them ideal for people with celiac disease or diabetes.

KEYWORDS: Indian Millets, Coarse cereals, Gluten free, Low Glycemic Index.

INTRODUCTION

India is among the top 5 exporters of millets in world. World export of millet has increased from $400 million in 2020 to $470 million in 2021 (ITC trade map) India exported millets worth $64.28 million in the year 2021-22, against $59.75 million in 2020-21. Share of Millet based value added products is negligible. India is the largest producer as well as the largest exporter of cereal products in the world. India's export of cereals stood at Rs. 96,011.42 Crore / 12,872.64 USD Millions during the year 2021-22. Rice (including Basmati and Non-Basmati) occupy the major share in India's total cereals export with 75% (in value terms) during the same period. Whereas, other cereals including wheat represent only a 25 % share of total cereals exported from India during this period.

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family Poaceae. They constitute an important source of food and fodder for millions of resource-poor farmers and play a vital role in ecological and economic security of India. These millets are also known as "coarse cereals" or "cereals of the poor". Indian Millets are nutritionally superior to wheat and rice as they are rich in protein, vitamins and minerals. They are also gluten-free and have a low glycemic index, making them ideal for people with celiac disease or diabetes.

CLASIFICATION OF MILLETS

Sr. No.	Millet	Botanical Name	Local Name
1.	Pearl Millet	Pennisetum glaucum .L.	Bajra
2.	Sorghum	Sorghum bicolor	Jowar
3.	Finger Millet	Eleusine coracana	Ragi
4.	Foxtail Millet	Eleusine coracana	Kangni
5.	Barnyard Millet	Echinochloa frumentacea	Sanwa
6.	Kodo Millet	Paspalum scrobiculatum	Kodo Dhan
7.	Proso Millet	Panicum miliaceum L.	Vari
8.	Little Millet	Panicum sumatrense	Kutki

PEARL MILLET

The most extensively cultivated millet is pearl millet. Large stems, leaves and heads characterize this summer cereal grass. Bajra is a type of millet and is one of the most cultivated crops in India. It is a short-duration crop and can be grown in both rain fed and irrigated conditions. Bajra is a rich source of proteins, minerals, and vitamins and is a good source of energy. It is also a good source of dietary fiber.

SORGHUM

Sorghum, also known as jowar, is a cereal grain that is grown in India. Sorghum is a crop from the Gramineae family that is high in carbohydrates. It is a drought-tolerant crop that can be grown in areas with little or no irrigation. Sorghum is a nutritious grain that is high in fiber and protein. It is also a good source of vitamins and minerals, including iron and magnesium. Sorghum is typically used to make flour, which is used to make bread, porridge and other food items. It is one of the staple crops for millions of semi-arid residents, it's also known as the "KING OF MILLETS".

FINGURE MILLET

Another significant staple grain in Eastern Africa and Asia is finger millet, often known as ragi in India (India, Nepal). At the top of the stem, the plant has many spikes or "fingers." The grains are tiny (1-2 mm in diameter). Finger millet grains are rich in minerals, dietary

fibre, polyphenols and proteins. Finger millet, which is rich in calcium, plays an important role in growing children, pregnant women as well as people suffering from obesity, diabetes, and malnutrition. It contains high amount of potassium for the proper functioning of the kidneys and brains and allows the brain and muscles to work smoothly.

FOXTAIL MILLET

Foxtail millet is one of the solid crop that can grow in poor, dry conditions and tolerate high temperatures. It is a fast growing plant, which means it requires less than 12 hours of daylight to grow. It is rich in carbohydrates which helps in balancing the blood sugar level in the body. Iron content is high in it. Foxtail millet may also improve overall immunity, malnutrition. It contains high amount of potassium for the proper functioning of the kidneys and brains and allows the brain and muscles to work smoothly.

BARNYARD MILLET

Barnyard Millet is popular in millets name list and also known as Sanwa. It is stacked with high amounts of dietary fibres that help improve bowel movement and aiding weight loss. It is rich in calcium and phosphorus, which can strengthen bone density. Barnyards are generally utilized as food for humans and as animal feed.

KODO MILLET

Kodo Millet, also known as Kodon Millet, is a digestible variant with higher amounts of lecithin amino acid. It has a significant effect on strengthening the nervous system. Kodo is a fantastic source of B vitamins, especially niacin, B6, and folic acid, among other vitamins and minerals. It contains calcium, iron, potassium, magnesium and zinc minerals. Being a gluten-free millet, it is great for gluten-intolerant individuals. It can relieve cardiovascular disorders such as high blood pressure and cholesterol levels when eaten regularly by postmenopausal women.

PROSO MILLET

Proso millet is rich in minerals, dietary fiber, polyphenols, vitamins and proteins. It is gluten-free and therefore, ideal for the gluten intolerant people. Proso millet contains high lecithin which supports the neural health system. It is rich in vitamins (niacin, B-complex vitamins, folic acid), minerals (P, Ca, Zn, Fe) and essential amino acids (methionine and cysteine).

LITTLE MILLET

Little Millet (Panicummiliare) is grown throughout India and is a traditional crop. It is a relative of proso millet but the seeds of little millet are much smaller than proso millet. it is also called Moraiyo, Kutki, Shavan and Sama. It is loaded with vitamin B and essential minerals such as Calcium, Iron, Zinc, and Potassium. Little Millet is largely used in Southern states of India in numerous traditional dishes. It is a healthier alternative to rice and does not cause weight gain.

CHEMICAL AND NUTRITIONAL COMPOSITION OF MILLET GRAIN

The millet grain is rich in fiber and minerals has sufficient quantity of carbohydrates (60.9-72.6%), protein (6.22- 11.6%) and fat (1.12-4.7%). Starch is the major constituent of the grain. The grain contains protein, albumin, globulin, prolamin and glutelin. Millets do not contain gluten and its slower hydrolysis makes it attractive to diabetics, celiac and ethnic groups. Particularly in developed countries, there is a growing demand for gluten free foods from people with celiac disease and other intolerance to wheat. Millets have unique nutrient value which is good for physical and mental health.

HEALTH BENEFITS OF MILLETS

Millets have potential health benefits and epidemiological studies have showed that consumption of millets reduces risk 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 are protective against several degenerative diseases such as metabolic syndrome and Parkinson's disease (Manach et al., 2005; Scalbert et al., 2005; Chandrasekara and Shahidi, 2012). The important nutrients present in millets include resistant starch, oligosaccharides, lipids, antioxidants such as phenolic acids, avenanthramides, flavonoids, lignans and phytosterols which are believed to be responsible for many health benefits (Miller, 2001; Edge et al., 2005).

- **Cardiovascular Diseases**

Being rich sources of magnesium, millets help in reducing blood pressure and risk of heart strokes especially in atherosclerosis. Also, the potassium present in millets helps in keeping blood pressure low by acting as a vasodilator and help to reduce cardiovascular risk. Also, the plant lignans present in millets have the ability to convert into animal lignans in presence of microflora in digestive system and protect against certain cancers and heart disease. The high

fiber present in millets plays a major role in cholesterol lowering eliminating LDL from the system and increasing the effects of HDL.

- **Diabetes Mellitus**

Diabetes mellitus is a chronic metabolic disorder characterized by hyperglycemia with alterations in carbohydrate, protein and lipid metabolism. It is considered as the most common endocrine disorder and results in deficient insulin production (type 1) or combined resistance to insulin action and the insulin-secretory response (type 2) (Saleh et al., 2013). The efficiency of insulin and glucose receptors in the body is increased by the significant levels of magnesium content present in millets and help in preventing diabetes. Finger millet based diets have shown lower glycemic response due to high fiber content and also alpha amylase inhibition properties which are known to reduce starch digestibility and absorption (Kumari and Sumathi, 2002)

- **Gastrointestinal Disorders**

Regulating digestive process can increase nutrient retention and reduce chances of more serious gastrointestinal conditions like gastric ulcers or colon cancer. Fiber content in millets helps in eliminating disorders like constipation, excess gas, bloating and cramping. An immune mediated enteropathic disease called celiac disease which is usually triggered by the ingestion of gluten in susceptible individuals (Catassi and Fasano, 2008). A gluten free diet primarily plays a major role in affecting food consumption in the grain food group. Replacing cereals like wheat, barley, rye-based foods made from gluten free grains, including rice, corn, sorghum, millet, amaranth, buck wheat, quinoa, wild rice may help people adhering to gluten free diet. (Thompson, 2009). As millets are gluten free, they have considerable potential in foods and beverages and can meet the growing demand for gluten free foods and will be suitable for individuals suffering from celiac disease. (Taylor et al., 2006; Taylor and Emmambux, 2008; Chandrasekara and Shahidi, 2011b and 2011c)

- **Detoxification (Anti-Oxidant Properties)**

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 human health (Tsao R, 2010). 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 29 mg polyphenolics/100 g and 2.22 mg tocopherol/100 g (wet basis).

Over 50 phenolic compounds belonging to several classes, namely, phenolic acids and their derivatives, dehydrodiferulates and dehydrotriferulates, flavan-3-ol monomers and dimers, flavonols, flavones, and flavanonols in 4 phenolics fractions of several whole millet grains (kodo, finger, foxtail, proso, little, and pearl millets) were positively or tentatively identified using HPLC and HPLC-tandem mass spectrometry (MS) (Chandrasekara and Shahidi, 2011a). Therefore, millet grains can be used as functional food ingredients and as sources of natural antioxidants. Kodo millet, finger millet, little millet, foxtail millet, barnyard millet, and sorghum bi colo rgrown in India and their white varieties were screened for free radical quenching of 1,1, diphenyl-2-picrylhydrazyl (DPPH) by electron spin resonance (Hegde and Chandra, 2005). Furthermore, finger millet extracts were found to have a potent radical-scavenging activity that is higher than those of wheat, rice, and other species of millet (Dykes and Rooney, 2006). In addition, defatted foxtail millet protein hydrolysates also exhibited antioxidant potency (Mohamed et al., 2012).

CONCLUSION

Though millets are nutritionally superior, its consumption has been decreased gradually due to the non- availability of processed clean grain in markets. To increase millet consumption among the urban population, development of processing technologies is a prerequisite. As a step towards this, under the NAIP project, IIMR has taken up the millet processing, and developed value added millet products. They have high fibre content, low sugar and vitamins and if consumed regularly they promote movement of the bowels, help detoxify the system, renders less blood sugar and cholesterol than eating fine flour or rice. Thus, millets may serve as a natural source of antioxidants in food applications and as a nutraceuticals and functional food ingredient in health promotion and disease risk reduction.

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