

A Study on the Health and Nutritional Benefits of Millets

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Abstract: In this era of climatic change, millets are the most convenient crops, which fit well in the current scenario of hunger, poverty, nutritional challenges, and marginal farming. This review focuses in detail on the potential health benefits, and with updated literature from the recent past. Millets store an ample amount of proteins, essential amino acids, dietary fibre, vitamins, minerals, essential fatty acids, antioxidants, and other phytochemicals attributes place them in “Nutraceuticals”. Due to lack of nutrients in diet lifestyles leads to numerous diseases like cardiovascular diseases, obesity and diabetes. Millets are rich in dietary fibers, antioxidants, protein, carbohydrates and fats. Millets are the ones that are cultivated in poor soils. The incorporation of millet into the daily diet of an individual might help in curing many health complications. Millet is an important ancient cereal crop known for its nutritional value. It has served as a staple food for various cultures for thousands of years, offering a rich source of carbohydrates, protein, fiber, vitamins, and minerals. Millet grains are small, round, and have a hard outer layer, making them versatile for processing into various food products. They are commonly ground into flour or grits for making porridge, bread, and crackers, and can be used in fermented foods like beer and sour dough. In the context of climate change, water scarcity, and global population growth, millet's role in ensuring foodsecurity is becoming increasingly important. Food scientists, technologists, and nutritionists are showing growing interest in millet due to its nutritional benefits and potential health advantages.

Keywords- Millet, nutritional value, nutraceuticals.

Introduction - Millets are considered as “minor cereals” and are the world's sixth most important cereal grains (Das et al. 2019; Sarita and Singh, 2016), which along with maize, sorghum, oats and barley are known as “coarse cereals”. Millets account for only 2% of the world cereal production and 95% of the world millet production comes from Asia and Africa (FAO, 2018). Millets belong to the family of grasses Poaceae (Gramineae). Sub family Panicoideae consists of millets: *Panicum miliaceum* L. (Common millet) also known as broomcorn millet is mostly grown in China, Afghanistan, India, Turkey; *Pennisetum glaucum* L. (Pearl millet) which is also known as Bajra, Bulrush, is mostly grown in Africa, India, the United States; *Setaria italica* L. (Foxtail millet) is also known as Italian millet and is mostly grown in Eurasia, China, India, Australia; *Digitaria exilis* Stapf (White Fonio) and *Digitaria iburua* Stapf (Black Fonio), also known as Hungry rice are mostly grown in Africa Sahel region; *Echinochloa esculenta* (A. Braun) H. Scholz (Japanese Barnyard Millet) also known as white millet is mostly grown in Japan, China, Korea; *Echinochloa frumentacea* Link (Indian Barnyard Millet) also known as Sama is mostly grown in India, China; *Panicum sumatrense* Roth (Little Millet) also known as Blue panic, is mostly grown in China, Pakistan, India, Nepal, Malaysia and *Paspalum*

scrobiculatum L. (Kodo millet) also known as Kodra is mostly grown in India Millets boost immunity, provide fodder for cattle, improve biodiversity, and protect the livelihood of farmers. The right composition of minerals, vitamins, and antioxidants present in the millet grains suggests the optimization of immune system functioning. High amount of resistant starch in millets ensure the slow and sustained glucose release into the blood stream and the supply of up to 2000–3000 calories per person per day (Muthamilarasan and Prasad, 2021).

Just like cereals, legumes that are known as “poor man's meat” are excellent sources of protein, minerals, dietary fibre and B vitamins. These include red gram, green gram, black gram, green peas that possess a good nutritional profile with potential health benefits (Kumari and Sangeetha, 2017). Both millets and legumes are known as “climate smart crops” and “smart -food” as these foods are good for us, the planet as well as the farmers. Pigeon pea and chicken pea are important sources of protein especially for the people who cannot afford animal source protein and are vegetarian. Both pigeon pea and chicken pea have an amino acid profile that is comparable to soybean but the sulfur containing amino acids such as methionine and cysteine are less. This deficiency can be complemented

by the use of coarse cereals called millets, which are naturally rich in methionine and cysteine. However, the lysine content of millets is less than that of pigeon pea and chicken pea (Anitha et al. 2020). The blend of millets with pulses or legumes have been known to enhance the overall acceptability of the product (Kumar et al. 2018). It was reported by Anitha et al. (2020), that pearl millet showed a higher iron, zinc content as compared to pigeon pea and chicken pea, while the protein digestibility was also higher. It was reported that, finger millet had the highest calcium content amongst the all. In a study conducted by Lardner et al. 2016, it was concluded that as compared to grass-legume hay, millet and barley had a higher nutritive value and may be excellent annual forages for extensive grazing.

Several traditional millet foods and beverages are consumed in Africa, Indian sub-continent and East Asia such as whole-grain foods, flatbreads, steamed meals, dumplings, porridges, puffed products, non-alcoholic beverages "Oshikundu" from Namibia; "Kunun-zaki" from Nigeria, Niger and Tchad; "Malwa/Ajon" from Uganda; "Uji" from Kenya, Uganda and Tanzania. Alcoholic beverages include "Kodo ko jaanr" from India, Nepal, and Bhutan; "Jandh" from Nepal, "Burukutu" from West Africa; "Koozh" and "Madua Apong" from India; "Xiao mi jiao" from Taiwan (Amadou, 2019). Millets have been an integral part of the Tribal communities in India like the Soligas tribe of BR Hills in Chamarajanagar district of Karnataka, that celebrate "Ragi Habba festival" with the harvesting of millets (Behera, 2017). Most of the pearl millet flour in India is used in baking chapatis "Bajre ki roti" (Reddy et al. 2018). "Madira ki Kheer" is a Barnyard millet porridge that is a popular sweet dish in Uttarakhand, India (Verma et al. 2018). The Muthuvan tribe in Kerala, India consumes Ragi (Finger millet) locally called "Kepa" for making a pudding called "Katty" (Rawat et al. 2021). In West Africa, "Ogi" (Porridge) is the staple food and infant meal that is prepared from fermented millet (Adebiyi et al. 2018). Pearl millet is used in several traditional ceremonies among the ethnic groups of Northern Benin, as a stimulator of milk production in wet nurses of "Mokole group" and in the production of mash flour, traditional foods such as "Foura" (Adeoti et al. 2017). In a study conducted by Poshadri et al. (2019), it was reported that energy-rich complementary weaning malted food sample comprising of sorghum, wheat, ragi, soybean may cause improvement in the growth and prevention of malnutrition in children, infants, and nursing mothers in tribal areas of Adilabad district, of India. Some of the millet-based foods in the Indian market are millet muesli, flour, dosa mix, multigrain choco malt, porridge, rava, chikkis, flakes, cookies, organic baby food, pops, roti (Alavi et al. 2019). Ethnic millet foods of Karnataka, India such as papads, chakli, fermented "Paddu" are highly nutritious and have a great potential for livelihood generation (Kahane et al. 2013).

Health benefits of millets-

Strong antioxidants help in increasing immunity.

Low glycemic Index help in decreasing diabetes.

Good source of magnesium keep heart healthy.

Gluten free keep gut healthy.

High dietary fibre helps in digestion and keep weight under control.

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 micro flora 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). 2.4 Cancer Millets 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.

Detoxification: 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, curcumin, 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).

Conclusion: Whilst a grain millets has very much importance in India, still more emphasis has been given to rice, wheat and maize production. Millets are small grain crops, cultivated on degraded poor soils. Over-reliance on cereals post-green-revolution has completely left these grains unnoticed. These grains are still regarded as orphan crops. Due to the rise of sedentary lifestyle many health ailments has risen like diabetes, cardiovascular diseases, obesity, gastrointestinal disorders and malnutrition. Millet cultivation would provide twofold benefits. As they would help in conserving resources by limiting the use of water, and the fertility of the soil and would help in health benefits

to society. These grains are a highly rich source of carbohydrates, proteins, vitamins, fats, minerals, and antioxidants. So, the addition of these grains to the daily diet will surely lead to a healthy lifestyle. Further the integration of various international, national programs with diet based on coarse grains will be highly beneficial. Increasing the use of these grains for a healthy lifestyle, gluten-free substitute, farmer beneficiaries, and conservation of natural resources, there is an urgent need for developing the processing technologies that will help in upgrading the shelf life of millets. Moreover, educating the population about consuming these grains for a healthy, disease-free life. Advancement in these nutritious, high-value grains will increase the immunity, health, and socio-economic status of the population.

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