Revival of Millets (Shree Anna) as a "Super Food" in the Daily Diet and Health Care

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Under nutrition as well as over nutrition are biggest problems in many nations. To achieve food and nutrition security, the food system must be transformed. Providing access to a cheap and wholesome food to everyone is one approach to get closer to our goal. Millets (Shree Anna) have the potential to be a game changer in the fight against hunger and malnutrition. Many health promoting nutrients as well as bioactive compounds such as dietary fibres, antioxidants, macro and micronutrients etc., are abundant in millets as compared to other staple cereals such as rice, wheat and maize. This plays a central role in the world nutritional security. Based on literature available, it is evident that the incorporation of millet and its constituents into various foodstuffs may be useful against undernourishment and also in several other health diseases. Therefore, this article will be highlighting about the beneficial features of millet in the present scenario as well as the strategies for the revival of millets in the daily diet and healthcare.

Introduction

Millets 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. Millets are termed as "yesterday's coarse grains and today's nutri-cereals." Millets are considered to be "future crops" as they are resistant to most of the pests and diseases and adapt well to the harsh environment of the arid and semi-arid regions of Asia and Africa. Millets are small seeded grains, the most common and important for food being sorghum (*Sorghum bicolor* L.), pearl millet (*Pennisetum glaucum*), finger millet (*Eleusine carocana*), teff (*Eragrostis tef*), proso millet (*Panicum miliaceum*), kodo millet (*Paspalum scrobiculatum*), foxtail millet (*Setaria italica*), little millet (*Panicum sumatrense*) and fonio (*Digitaris exilis*) (Fig.1). After decades of negligence, nutri-cereals are making a strong comeback in the Indian cereal's production segment. India dominates the global production of millets with a total share of about 40.62% and an estimated production of about 10.91 mt during 2018–2019. Although India ranks 1st in nutri-rich millet production and 2nd in rice and pulses across the globe, it also unfortunately ranks 2nd in child malnutrition incidences. India is home to more than 1/3rd of the world's malnourished children.

By contrast, the country has also become a hub for diabetic and overweight populace, putting the country under a double burden of malnutrition. The majority of millets are three to five times more nutritious than most cereals (rice, wheat, maize) in terms of vitamins, fibre, proteins, and minerals (calcium and iron) and are gluten-free; hence, they are known as "superfoods". The nutri-rich millets are the viable solution to reduce the rising incidences of malnutrition and metabolic disorders and can enhance the nutrition and food security of the country.

Fig. 1. Millets crops grown in millets crop cafeteria at KVK-2 Sitapur, U.P.

Millets are a highly nutritious crop and contain considerable amounts of vitamins and minerals. Millets are a good source of energy, dietary fiber, slowly digestible starch, and resistant starch, and thus provide sustained release of glucose and thereby satiety. Compared to cereals, millets are a good source of protein and sulphur containing amino acids (methionine and cysteine) and have a better fatty acid profile.

However, millets contain a limited amount of lysine and tryptophan, which varies with the cultivar. Millets are rich in vitamin E and vitamin B and in minerals such as calcium, phosphorus, magnesium, manganese, potassium and iron.

Consumption of millets helps manage hyperglycaemia due to their complex carbohydrate and high dietary fibre content, thus making millets a perfect food for the diabetic populace. Therefore, millets play an important role in the modern diet as a potential source of essential nutrients, especially in underdeveloped and developing countries. Although millets have a diversified and high food value, and their consumption, especially by the Indian populace, has not reached a significant level due to various factors. Recently, millet grains have been slowly fuelling the start-up revolution to improve nutri-rich food availability and create employment.

Potentials of millets in various diseases

Utilization of whole grain of millet is associated with health benefits, such as its hypoglycaemic, hypocholestrolemic characteristics, antitumerogenic, antidiarrheal, anti-inflammatory, atherosclerogenic, antimicrobial, and antiulcerative properties. Additionally, it can reduce the risk of gastrointestinal malignancies, type 2 diabetes, cardiovascular diseases, and a variety of other illnesses (Table 1).

Pearl millet helps in reducing respiratory disease, migraine, and gall stones. It is reported to have anticancerous, antidiabetic, antioxidant, anti-inflammatory property. It helps in increasing hemoglobin, antiallergic, helps in dealing with constipation, antiulcerative properties, helps in weight loss and essential for bone growth and development, prevents cardio-vascular diseases, regulates blood pressure, helpful in celiac disease.

Table 1. Bioactive compound of various millets and their associated health benefits

Millets	Bioactive compound	Associated health benefits
Pearl Millet (*Pennisetum glaucum*)	Phytonutrient – Lignin, flavonoid, Apigenin, Myricetin	Prevent hormone-dependent cancer (Breast Cancer) and cardiac arrests, antifungal, anti-ulcerative properties
Kodo Millet (*Paspalum scrobiculatum*)	Apigenin, Kaempherol, vitexin, isovitexin, leutolin, quercetin	Anti-diabetic, Anti-rheumatic, anticancerous
Barnyard Millet (*Echinochloa esculenta*)	Luteolin, tricin, N-(p-coumaroyl) serotonin	Anti-diabetic, Anti-rheumatic, anticancerous
Finger Millet (*Eleusine coracana*)	Catechin, gallocatehin, epicatechin, epigallocatechin, taxifolin, vitexin, tricin, myricetin, Leuteolin, quercetin, apigenin, Kaempherol, diadzein, Pyrocyanidin B1, Pyrocyanidin B2	Anti-turmogenic, Anti- diabetic, anti-microbial, and antioxidant properties
Foxtail Millet (*Setaria italica*)	Catechin, quercetin, apigenin, Kaempherol	Anti-turmogenic, Anti- diabetic, anti-microbial, and antioxidant properties
Little Millet (*Panicum sumatrense*)	Apigenin	Anti-diabetic, Anti-rheumatic, anticancerous
Proso Millet (*Panicum miliaceum*)	Apigenin, Kaempherol, myricetin	Anti-diabetic, Anti-rheumatic, anticancerous

Source: Suma and Urooj (2014), Thakur and Tiwari (2019)

Barnyard millet is useful in the treatment of biliousness and constipation and allergic diseases such as atopic dermatitis. It is best in lowering blood glucose and lipid levels therefore can be potentially recommended for patients with cardiovascular disease and diabetes mellitus. It is also reported to have good antioxidant potential, anti-carcinogenic, anti-inflammatory, antimicrobial, having a wound healing capacity. Due to its high iron content, barnyard millet can help pregnant women who suffer from anaemia.

Foxtail millet is suitable for individuals suffering from diabetes mellitus due to its low glycaemic index. It possess several health benefits like prevention of cancer, hypoglycaemic, and hypolipidemic effects, curing dementia, helps in maintaining cholesterol level, antiproliferative activity, antilipidemic activity, reduces inflammation, potentially promoting anticancer, antiaging and improves the overall digestive health, increases kidney functionality, helps in development of body tissue and energy metabolism.

Finger millet also helps in maintaining young and youthful skin. It is an excellent source of calcium and iron that helps to strengthen body bones and is a boon for anaemic patients and also for those with low haemoglobin levels.

Proso millet is potentially helpful in preventing cancer, heart disease and managing liver disease and diabetes. Low glycaemic index grains are beneficial for treating type 2 diabetes and cardiovascular conditions. It helps in reducing cholesterol and high blood pressure level and also helps in preventing cancer and reduces the risk of heart diseases, prevents liver injuries, celiac disease, and obesity. It also slows down the aging process and may protect against age-onset degenerative diseases.

Little millet is helpful for diabetic patients, reduces blood glucose level, improves heart health, good for lowering cholesterol level and helps in weight loss. It exhibits hypoglycaemic and hypolipidemic effects and prevents metabolic disorder.

Kodo millet also has numerous health benefits like antidiabetic, antioxidant, antimicrobial, anti-obesity, anti-cholesterol, anti-mutagenic, anti-oestrogenic, anti-carcinogenic, anti-inflammatory, antihypertension, and antiviral effects. It is useful in curing asthma, migraine, blood pressure, aging, heart attack, cardiovascular disease, and atherosclerosis.

Sorghum is beneficial in curing diseases such as obesity, diabetes, celiac disease, dyslipidaemia, cardiovascular disease, cancer, heart diseases, dyslipidaemia, maintains cholesterol level, bone health, hypertension, and prevents anaemia. The grain also has antioxidant, anti-inflammatory, antimicrobial, antithrombotic, and anticancer activity.

The productivity of all the millets can be easily increased from their current levels of productivity, which would require integration of water conservation, adopting the newest high yielding crop cultivars, integrated nutrient management and integrated insect-pest and disease management. The adequate number of demonstrations using cluster-approach in different agro-ecological zone of Sitapur district should be conducted using interventions. This would go a long way in convincing the farming community to adopt new technologies for enhancing millet productivity. However, on the long term basis, new cultivars with high production potential will determine enhancement in their production.

However, the millet supply chain suffers from inconsistent supply and demand that prevents its commercial viability. Lack of public awareness about nutritional benefit of millets has led to limited adoption of millet-based products. Limited distribution and lack of market knowledge has led to sub optimal reach, lower price realization and wastage.

Additionally millets have the potential to help achieve the sustainable development goals (SDGs) mainly SDG2 (Zero hunger), SDG3 (Good health and wellbeing), SDG12 (Sustainable consumption and production), and SDG13 (Climate action).

Food products developed from millets

Sorghum is used as an important ingredient for the preparation of gluten-free breads, cookies, porridge (madeda, logma or asida), tortillas, enjera, pasta, muffins, nefro, cupcakes,

kisra, ladoo, chapati, chaat, beverages, cake, noodles, extruded products, thekua, tender sweet sorghum (hurda).

Pearl millet is generally used in the preparation of various value-added food products such as cutlets, weaning food, vermicelli, instant beverage powder, biscuits, upma mixes, bread, cakes, muffins, roti / chapati, instant idli, dhokla, uthapam, kheer, extruded product, cookies, snack bar and beverages.

Fig. 2. Glimpses of millet incorporated food products developed at KVK-2, Sitapur, U.P.

Barnyard millet is generally used in the preparation of different value-added products such as vermicelli, roti/chapati, noodles, biscuits, cookies, malt based weaning food, extruded products, snack food, ladoo, halwa, biryani, dosa.

Finger millet is generally used in the form of the whole meal for preparation of traditional foods, such as roti / chapati, mudde (dumpling), ambali (thin porridge), porridge, malting and weaning foods, papad, bakery products (biscuit, nan-khatai, muffins, rusk, cake, and bread), fermented foods (idli, dosa), dhokla, uthapam, chikki, beverages, pasta, vermicelli, noodles, ladoo, finger millet fritters, vada, soup, extruded products (Fig. 2).

Foxtail millet is used as an important ingredient for preparing halwa, ladoo, noodles, soup, beverages, cereal porridges, ready to eat extruded snacks, cookies, pancakes, cupcakes, biscuits, biryani, idli, dosa, dhokla, rice, upma, baby food, bread, shakkarpara, ladoo.

Proso millet is generally used for preparing chakli, noodles, cookies, chapati, kichari, cheela, idli, dosa, namkeen, biscuits, halwa, Payasam, roti, bread, ready-to-eat breakfast cereal. Little millet is generally used in the preparation of samai-payasam, roti, dosa, idli, pongal, khichadi, ladoo, chakli, bread, extruded snack, paddu, kheer, biscuitsand pudding.

Kodo millet is used as an important ingredient for preparing roti/chapati, bread, cakes, extrusion of cereal-based products, gravy, soup, porridge, instant powders, dosa, idli, ladoo, pudding, chakli, pongal, puttu, cutlet, methi rice, sev, cookies, payasam, boli, sheera, pakoda, halwa, upma, idli, adai, murukkus, biscuits, yogurt, papad, adhirasam, vermicelli, pasta (Fig. 3).

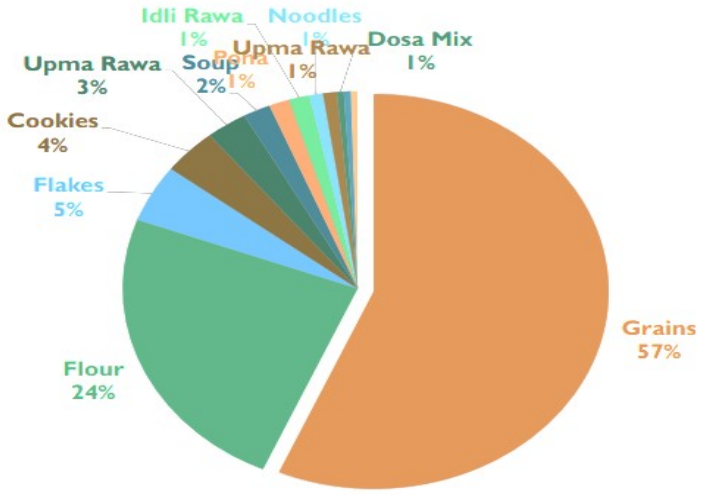

Fig. 3. Millets products in the market (*Source*: ICAR-IIMR, 2022)

How much millet can one consume per day?

According to ICMR-National Institute of Nutrition, the quantity of millet should be around 33% of the total cereal consumption during the day. For example, for a reference man with sedentary activity 275 g of cereals is recommended including nutri-cereals. So, if a person is consuming millets, then he can consume about 1/3rd or 33% (90-100 g/day) of the recommended quantity. If millet is soaked overnight, rinsed and then cooked, the anti-nutrient content can be decreased. Other processing like germination and fermentation also can be done for reducing the anti-nutrient content and to increase the bio availability of nutrients specially minerals.

Conclusion

There is a need to restore the lost interest in millets that deserves recognition for its nutritional qualities and potential health benefits. Provision of such nutritionally superior grains in consumer friendly ready to eat convenient form would, promote enhanced utilization for better nutrition of the modern consumers and also encourage the farming and processing sectors.