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MINI REVIEW

Overview on Millets

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ABSTRACT

Millets are one of the oldest foods known to humans and possibly the first cereal grain to be used for domestic purposes. Millets have been main staples of the people of semi-arid tropics of Asia and Africa for centuries where other crops do not grow well. Since ancient times, millet has been widely consumed in Asia and India as well. The Indian flatbread *roti* is made from ground millet seeds. In spite of all these extraordinary qualities and capacities of millet farming systems, the area under millet production has been shrinking over the last five decades and rapidly after the green revolution period. The tiny "grain" is gluten-free and packed with vitamins and minerals. Millet grain is highly nutritious with good quality protein, rich in minerals, dietary fibre, phyto-chemicals and vitamins. The nutritional composition of the millets is compared with that of rice and wheat. The protein content of foxtail millet, proso millet and pearl millet are comparatively higher than the protein content in wheat. The fibre content of kodo, little, foxtail and barnyard millet is higher. Finger millet has a remarkable amount of calcium 344.00mg / 100g. Cereal based food products are supplemented with millets and has become increasingly popular due to nutritional and economic advantages. Value added products from millet have the potential to add value to business and has a large potential for growth as consumers believe that millets and millet based foods contribute directly to their health.

Key words *Millets, Origin, Production, Nutritive value, Value Addition*

Millets are one of the oldest foods known to humans & possibly the first cereal grain to be used for domestic purposes. It is a cereal crop plant belonging to the grass family Graminae. The term millet refers to several types of small seeded annual grasses that belong to the species under five genera namely, *Panicum, Setaria, Echinocloa, Pennisetum* and *Paspalum* in the tribe *Paniceae* and one genus *Eleusine,* in the tribe *Chloridea*e. The origin of millet is diverse with varieties coming from both Asia and Africa. Millets have been main staples of the people of semi-arid tropics of Asia and Africa for centuries where other crops do not grow well. They have been cultivated since time immemorial. There are around 6,000 varieties of millet grown throughout the world. Millets are underutilized in many developed countries. There is an immense potential to process millet grains into value added foods. (Chandrasekara and shahidi, 2010).

History

Millet is thought to have originated in North Africa, specifically in Ethiopia, where it has been consumed since prehistoric times. There is even mention of millet in the Bible as an ingredient for unleavened bread. Millet is still an extremely important food staple in Africa where finely ground millet is used to make traditional flat bread known as *injera*. Since ancient times, millet has been widely consumed in Asia and India as well. The Indian flatbread *roti* is made from ground millet seeds. In the Middle Ages, before potatoes and corn were introduced, millet became a staple grain in Europe, especially in countries in Eastern Europe. The Setaria variety of millet was introduced into the United States in the 19th century. While millet has been used primarily for birdseed and livestock fodder in Western Europe and North America, it is now gaining popularity as a delicious and nutritious grain that can be enjoyed for both its unique virtues as well as the fact that it is a gluten-free grain alternative to wheat. The majority of the world's commercial millet crop is produced by India, China and Nigeria.

Origin

The origin of millets their scientific name and common names are as follows.

Scientific Name	Common Name	Origin
Sorghum bicolor	Sorghum, great millet, guinea corn, kafir corn, aura, mtama, jowar, cholam. kaoliang, milo, milo-maize	Northeast region of Africa (Ethiopia-Sudan border)
Pennisetum glaucum	Pearl millet, cumbu, spiked millet, bajra, bulrush millet, candle millet, dark millet	Tropical West Africa
Setaria italica	Foxtail millet, Thenai, Italian millet, German millet, Hungarian millet, Siberian millet	Eastern Asia (China)
Panicum sumatrense	Little millet, Samai	Southeast Asia
Paspalum scrobiculatum	Kodo millet, Varagu	India
Panicum miliaceum	Proso millet, common millet, hog millet, broom-corn millet, Russian millet, brown corn, Panivaragu	Central and Eastern Asia
Echinochloa crusgalli and Echinochloa coracana	Barnyard millet, sawa millet, Japanese barnyard millet, Kudhiraivali	Japan
Eleusine coracana	Finger millet, African millet, koracan, ragi, wimbi, bulo, telebun, Ragi	Uganda or neighbouring region

Gopalan *et al*., 2009

Grow fertile even on the poor soils

Most of the millets grow well on low fertile soils. Millets like Pearl millet can also be grown on sandy soils whereas finger millet grows well in saline soils. Barnyard millet thrives in low fertile soils, where other crops like rice, struggle to grow in such soils. Many of them are also grown to reclaim soils. Poor farmers in dry land India are owners of very poor lands. The only crops that sustain agriculture and food security on these lands are millets. If millets could flourish in ecological zones where average rainfall is less than 500 mm using soils that are sandy and slightly acid, it is a testimony for their, hardiness and extraordinary capacity to survive very harsh conditions. That is why millets can withstand drought like conditions in the Deccan and Rajasthan and produce food and fodder for people and livestock, respectively.

No demand for synthetic fertilisers

They can grow well with the use of farmyard manures and household produced bio fertilisers as nutrients, so usage of synthetic fertilizers are avoided. There is no demand for chemical fertilizers for the growth of millets. Under dry land conditions, even in the absence of chemical fertilizers millets grow better. In recent years, farmers have also started using bio-fertilisers such as vermin compost.

Pest free crops

Most millets such as foxtail, little millet, kodo millet etc., are totally pest free when grown in traditional local landraces and under ecological conditions. And hence do not need any pesticides. Even in storage conditions, millets not only not need any fumigants, but act as anti pest agents to store delicate pulses such as green gram.

Best cropping system

Millets grown under traditional practices are not just crops but a best Farming System. Most millet fields are inherently bio diverse. Five to fifteen crops are planted on the same space at the same time. The Baranaja cropping systems in the Himalayas are a testimony to this. The Pannendu Pantalu system of the South is a holistic farming system that grows millets in combination with pulses and oilseeds.

Challenge crops:

Millets are capable of growing under drought conditions, and can withstand higher heat regimes. Millets grow under non-irrigated conditions in low rainfall regimes as between 200 mm and 500 mm. They are capable to face the water stress and grow. Millets are a good storehouse of nutrients in large quantities. They include major and micro nutrients needed by the human body. Hence they can help withstand malnutrition.

Government Allocation & Scheme Initiation

Government has announced an allocation of Rs. 300 Crores in 2011-12 under Rashtriya Krishi Vikas Yojana for promotion of millets as Nutri-cereals. Scheme on Initiative for Nutrition Security through Intensive Millets Promotion has been formulated to operationalize the announcement. The scheme aims to demonstrate the improved production and post-harvest technologies in an integrated manner with visible impact to catalyze increased production of millets in the country. Besides increasing production of millets, the Scheme through processing and value addition

techniques is expected to generate consumer demand for millet based food products (INSIMP, 2011-12).

Millet production

Top twenty millet producing countries include India, Nigeria, Niger, China, Burkina Faso, Russian Federation, Mali, Sudan, Uganda, Senegal, Chad, Ethiopia, Nepal, Tanzania, USA, Pakistan, Myanmar, Ghana, Ukraine and Angola (Food and Agricultural Organization of United Nations). The world's millet production is shared by South and East Asia (about 60%), Eurasia and Central Asia (14%), Africa (16%) and rest of the World (10%). India is the largest producer of millet grains, producing about 33-37% of a total of 28 million tonnes of the World produce. Minor millets are grown over 7 million hectares of land in India, producing 5 million tons of grains. The richness of millet varieties in the dry lands of southern India is similar to the diversity seen in Africa. (Phanikumar, 2010).

The world production of millets is around 37.0 million tonnes where in finger millet contributed by India during 1993-1994 was 2.9 million tonnes (Agricultural Situation in India, 1993). Finger millet alone accounts for 2.6 million hectares, producing 3 million tons and providing staple food for people in Karnataka, Tamil Nadu, Andhra Pradesh, Orissa, Maharashtra and Bihar (Phanikumar, 2010). Finger millet constitutes about 81% of the minor millets produced in India and the rest by kodo millet, foxtail millet and little millet. (Pradhan *et al.*, 2010)

In recent years, millets have been recognized as important substitutes for major cereal crops to hope up with the world foods storage and to meet the demands of increasing population of both developing and developed countries. Millet grains which account for about one sixth of the total food grain production hold an important place in the food grain economy of India (Shree *et al.*, 2008)

Store house of Nutrients

The millet now referred as Nutri-cereal instead of coarse grain contains higher proportion of complex carbohydrates, resistant starch and slow rising sugar. They are high in fibre with soluble fibre content from 3.4 to 6.5 percent. Low in fat from 1.1 to 5.0 percent. Rich in B vitamins especially niacin, pyridoxine and folic acid. Millets offer good amount of calcium, iron, potassium, magnesium and zinc. The nutrient content of millet is better than rice or wheat.

Millets contain about 8.0 percent protein and 4.0 percent fat. They are rich source of vitamins and minerals. Millets are especially rich in calcium. The dietary carbohydrates content of millets is also relatively high. Prolamines and glutelins form the major portion of their proteins. The fats from millet contain a higher portion of unsaturated fatty acids and supply essential fatty acids. Although a considerable portion of nutrients is concentrated in the seed coat, the bioavailability of the nutrients presents in the endosperm is higher than the seed coat nutrients. Anti nutritional factors such as phytate and polyphenols are also present in millets but they are mostly confined to the seed coat and the milled millets are generally free from the anti-nutritional factors (Kumar, 2010).

Millets contain higher proportion of unavailable carbohydrate and release of sugar from millet is slow. Millet protein contains amino acids in balanced proportions and is rich in methionine, cysteine and lysine. These are especially beneficial to vegetarians who depend on plant food for their protein nourishment. Important vitamins namely thiamine, riboflavin and niacin are present in high quantities. Millets, a rich source of dietary fibre provide a wide range of nutrients and phytochemicals including dietary fibre, vitamin E, magnesium and folate that optimize health (Thilagavathy *et al.,* 2010).

Finger millet is rich in protein, iron, calcium, phosphorus, fibre and vitamin content. The calcium content is higher than all cereals and iodine content is said to be highest among all the food grains. Ragi has best quality protein along with the presence of essential amino acids, Vitamin-A, Vitamin-B and phosphorus (Gopalan *et al*., 2004). Ragi is a good source of diet for growing children, expecting women's, old age people and patients. Ragi provides highest level antioxidants properties, phyto-chemicals, which makes it easily and slowly digestible. Hence it helps to control blood glucose levels in diabetic patients very efficiently. The bulkiness of the fibres and the slower digestion rate makes us feel fuller on, fewer calories and therefore may help to prevent us from eating excess calories. (Kang *et al.*, 2008 and Lakshmi and Sumathi, 2002).

Millets such as bajra, thenai, varagu and white oats are rich sources of fibre and complex carbohydrates. These grain flours in combination with wheat flour made into chappathis would provide a diet rich in fibre and complex carbohydrates. (Thilagavathy *et al.,* 2010).

Nutritive value of millets (per 100g)

Crop / Nutrient	Protein (g)	Fat (g)	Fibre (g)	Minerals (g)	Iron (mg)	Calcium (mg)	Phosphorus (mg)
Rice	6.4	0.4	0.2	0.7	1.0	9.0	143
Wheat	11.8	1.5	1.2	1.5	5.3	41	306
Sorghum	10.4	1.9	1.6	1.6	4.1	25	222
Pearl millet	11.6	5.0	1.2	2.3	8.0	42	296
Finger millet	7.3	1.3	3.6	2.7	3.9	344	283
Foxtail millet	12.3	4.3	8.0	3.3	2.8	31	290
Proso millet	12.5	1.1	2.2	1.9	0.8	14	206
Kodo millet	8.3	1.4	9.0	2.6	0.5	27	188
Little millet	7.7	4.7	7.6	1.5	9.3	17	220
Barnyard millet	6.2	2.2	9.8	4.4	5.0	20	280

(Gopalan *et al*., 2009)

Therapeutic advantage of millets

Diabetic Mellitus is the most common metabolic disorder affecting human with health complications. Change in life style, poor dietary habits and stress lead to dietary complications. Millets being rich in complex carbohydrate, low fat, richness of fibre and the characteristic slow release of sugar are a good option to include in diabetic diet. Thus millets are hypocholestremic and hypoglycaemic effect on humans. Millets help to minimize the undesirable fermentation of undigested food components in the gut and binding with toxins, discharging them with stools in the colon. Thus brings down the incidence of colon cancer, constipation and gastro-intestinal complications. It is reported that cardiovascular diseases, duodenal ulcers and hyperglycaemia occur rarely in regular millet eaters (Viyalakshmi *et al.*, 2006).

Millets as Convenience foods

Cereal based food products are supplemented with millets and has become increasingly popular due to nutritional and economic advantages. Value added products from millet have the potential to add value to business and has a large potential for growth as consumers believe that millets and millet based foods contribute directly to their health. The millet grains offer many opportunities for the development of diversified food products like bakery and puffed products, quick cooking cereals, ready-to-eat snacks, supplementary foods, weaning foods and more importantly health foods by adopting appropriate milling and processing techniques (Seetharam *et al.*, 2001). However their preparation is time consuming and laborious, with the result that convenience foods based on traditional processing has entered the market with huge success (Arya, 1992).

1. Breakfast foods - Multigrain dosa mix Millet paniyaram mix, millet pongal mix, millet paniyaram mix, millet adai mix and millet puttu mix
2. Lunch - Multigrain Sambar rice mix, Multigrain Tomato rice mix, Multigrain Bisibele bath mix, Multigrain Biriyani, Pulav, Jeera mix
3. Health Foods – Nutrimalt, Thenai laddu (Nutriball)
4. Nutritious blends - Nutri beverage, Malted products
5. Snacks - Millet Khakhra, Millet murukku, Millet bar, Millet laddu, Millet blended chocolate.

All over the country, the market driven convenient foods are penetrated in retail markets. Convenient foods such as instant breakfast foods once considered as rich man food has now become an essential food item of majority of population especially among working women. The popularity of convenience food is due to increase in shelf life, unique taste and availability at reasonable cost. With these prevailing scenario, the tune of popularizing millet based convenient foods has got good potential to reach the households in a new brand.

The availability of fine cereals like rice and wheat reduced the search for millets in daily diet. It is projected that millet consumption would continue to fall at about 0.5 percent per annum. At

this scenario the planners, researchers and consumers are embedded with the thought of millets, the forgotten millet treasure in India. National level millet promotion targets are focused to improve the availability and consumer reach for millets.

Millets need very little inputs for their sustenance and require only 25% of the water consumed by crops such as sugarcane and banana. They can grow well with the use of farmyard manures and household produced bio fertilisers as nutrients, so usage of synthetic fertilizers are avoided. They can also be termed as pest free crops since they are not attacked by pests during their growth or storage. If there is any cropping system that can withstand these challenges, survive and flourish, it is the millet system. In spite of all these extraordinary qualities and capacities of millet farming systems, the area under millet production has been shrinking over the last five decades and rapidly after the green revolution period.

Millets are highly nutritious, non-glutinous and non-acid forming foods. Hence they are soothing and easy to digest. They are considered to be the least allergenic and most digestible grains available. Due to urbanization, increase in health awareness and buying capacity among city dwellers, the demand for processed and convenience foods have increased drastically. Millets are much cheaper, but they have to be properly processed for further usage. About 50 million Indians suffer from diabetes, 15% of the Indian population are obese and India ranks 128th among all the mal-nutrition countries. Hence, there is a need to educate people about the health and nutritional benefits of millets to increase the consumption of millets and millet based products to save people from health and malnutrition related issues.

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