

## **MILLETS-THE NUTRIMENTAL POTENT ETHNO-MEDICINAL GRASSES: A REVIEW**

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Article Received on  
08 Dec 2015,

Revised on 29 Dec 2015,  
Accepted on 18 Jan 2016

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### **ABSTRACT**

Millets are a group of highly variable small-seeded grasses, widely grown around the world as cereal crops/grains. Millet is tiny in size and round in shape and can be white, gray, yellow or red. Millets are very high in their nutrition content. Each millets are three to five times nutritionally superior to rice and wheat in terms of proteins, minerals and vitamins. Millets are rich in B vitamins, calcium, iron, potassium, magnesium, zinc, also gluten-free and has low-GI (Glycemic index) thus millets are suitable for people allergies/intolerance of wheat. Also for diabetic, weight loss millets are excellent. It helps to lower type 2 diabetic and reduces the risk of heart disease Millets are a great source

of starch, making it a high-energy food. It is also an excellent source of protein and fiber. Millets are mostly pest-free and low fertilizer used in growth. Millets can be cooked as we make rice and serve with dal, sambar, rasama or any curry of our choice. We can also make various dosa, idli, vada, bajjis/pakorras, murrukus/chakkli, nipatlu, pongal, mudda (dumpling), khichdi, pulav/biriyani, upma, sweets from millets, baked products such as bread and biscuits, or cooked just like boiled rice. they can also be use in baking, so we can include millets in our diet in more exciting way. Millets can be used to a whole variety of food that we consume everyday. They are ideal replacements to wheat and rice for their higher nutritional value.

**KEYWORDS:** Millets, Nutritional, Ethno medicinal, Grasses.

### **INTRODUCTION**

Poaceae –The grass family is the fourth largest family of the flowering plants. It includes about 700-800 genera and 11000-13000 species distributed world wide. Apart from a high degree of taxonomic diversity, the. family has unmatched ecological and economic

importance. With its origin in the early cretaceous and major diversification in the mid Cenozoic, the family at present covers nearly a fifth of land surface (Arabaci and Yildiz, 2004; Ture and Bell, 2004) and occurs in nearly all the habitats of the world (Clayton and Renvoize, 1986; Ture and Bocuk, 2007).

All the cereals and millets are cultivated grasses. Sugarcane, the main source of sugar around the world is also a cultivated grass species. Besides, grasses constitute the main source of forage and fodder for livestock. Apart from food and fodder several grasses are used to extract of aromatic oils and scents (Kaul and Vats, 1998; Khanuja et al., 2005; Kim et al., 2005; Bhuiyan et al., 2008; Sujatha, 2010). Grasses also comprise the main source of green cover of our lawns and landscape for tourism and sports. Also, their use in handicraft and cottage industry is well known.

Millets are a group of highly variable small-seeded grasses, widely grown around the world as cereal crops or grains for fodder and human food. Millets are important crops in the semiarid tropics of Asia and Africa (especially in India, Nigeria and Niger), with 97% of millet production in developing countries. The crop is favored due to its productivity and short growing season under dry, high-temperature conditions.

The most widely grown millet is pearl millet, which is an important crop in India and parts of Africa. Finger millet, proso millet and foxtail millet are also important crop species. In the developed world, millet are less important. For example, in the United States, only proso millet is significant and it is mostly grown for bird seed.

While millets are indigenous to many parts of the world, it is believed that they had an evolutionary origin in tropical western Africa, as that is where the greatest number of both wild and cultivated forms exist. Millets have been important food staples in human history, particularly in Asia and Africa. They have been in cultivation in East Asia for the last 10,000 years. The minor millets consumption has been in practice since the beginning of ancient civilizations of world. Generally, the millets are small-grained, annual, warm-weather cereals. They are highly tolerant to extreme weather conditions such as drought and are nutritious compared to the major cereals such as rice and wheat. They contain low phytic acid and are rich in dietary fiber, iron, calcium and B vitamins. Moreover, these millets release sugar slowly in the blood and also diminish the glucose absorption. These properties of the minor millets made the present consumers attracted to the consumption of millets.

The millet varieties are grouped as following.

**A:- Major millets** (the most widely cultivated species).

**Tribe: Eragrostideae**

- *Eleusine coracana* (Linn.) Gaertn.

**Tribe: Paniceae**

- *Panicum miliaceum* Linn.
- *Pennisetum glaucum* (Linn.) R. Br.
- *Setaria italica* (Linn.) P. Beauv.

**Tribe: Andropogoneae**

- *Sorghum bicolor* L. Moench
- *Zea mays* Linn.

**B:- Minor millets**

**Tribe: Eragrostideae**

- *Eragrostis tef* (Zucc.) Trotter.

**Tribe: Paniceae**

- *Digitaria sanguinalis* Linn.
- *Echinochloa frumentacea* (Roxb.) Link.
- *Echinochloa esculenta* (A. Braun) H. Scholz.
- *Panicum sumatrense* Roth ex Roem Schult.
- *Panicum miliare* Lamk.
- *Paspalum scrobiculatum* Linn.
- *Setaria verticillata* (Linn.) P. Beauv.
- *Urochloa panicoides* P. Beauv.

**Tribe: Andropogoneae**

- *Coix lacryma-jobi* Linn.

Pseudocereals such as buck wheat – *Fagopyrum esculentum* Linn. and *Fagopyrum tataricum* Linn. Kuttu, Ugal and amaranth *Amaranthus hypochondriacus* Linn. Ram dana, Chaulai and many other less and underutilized crops are also cultivated for food.

Chinese legends attribute the domestication of millet to Shennong, the legendary Emperor of China. Specialized archaeologists called palaeo ethnobotanists, relying on data such as the relative abundance of charred grains found in archaeological sites, hypothesize that the cultivation of millets was of greater prevalence in prehistory than rice, especially in northern China and Korea. Millets also formed important parts of the prehistoric diet in Indian, Chinese Neolithic and Korean Mumun societies. Broomcorn millet, proso millet (*Panicum miliaceum*) and foxtail millet (*Setaria italica*) were important crops beginning in the Early Neolithic of China. For example, some of the earliest evidence of millet cultivation in China was found at Cishan (north). *Cishan* dates for common millet husk phytoliths and biomolecular components have been identified around 8300-6700 BC in storage pits along with remains of pit-houses, pottery and stone tools related to millet cultivation. Evidence at Cishan for foxtail millet dates back to around 65000 BC. A 4,000-year-old well-preserved bowl containing well-preserved noodles made from foxtail millet and broomcorn millet was found at the Lajia archaeological site in China.

Palaeo ethnobotanists have found evidence of the cultivation of millet in the Korean Peninsula dating to the Middle Jeulmun pottery period (around 3500-2000 BC). Millet continued to be an important element in the intensive, multi cropping agriculture of the Mumun pottery period (about 1500-300 BC) in Korea. Millets and their wild ancestors, such as barnyard grass and panic grass, were also cultivated in Japan during the Jomon period some time after 4000 BC.

Millet made its way from China to the Black Sea region of Europe by 5000 BC. The cultivation of common millet as the earliest dry crop in East Asia has been attributed to its resistance to drought and this has been suggested to have aided its spread.

Research on millets is carried out by the International Crops Research Institute for the Semi-Arid Tropics in Telangana, India and by the USDA-ARS at Tifton, Georgia, USA. Project Co-ordinating Unit (Millets), University of Agricultural Sciences Gandhi Krishi Vignana Kendra, Bangalore has been recognized as a National Active Germ plasm Site (NAGs) for minor millets.

India is the world's largest producer of millet. In the 1970s, all of the millet crops harvested in India were used as a food staple. By the 2000s, the annual millet production had increased in India, yet per capita consumption of millet had dropped by between 50% to 75% in different regions of the country. As of 2005, most millet produced in India is being used for

alternative applications such as livestock fodder and alcohol production. Indian organizations are discussing ways to increase millet use as food to encourage more production; however, they have found that some consumers now prefer the taste of other grains. In 2010, the average yield of millet crops worldwide was 0.83 tonnes per hectare. The most productive millet farms in the world were in France, with a nationwide average yield of 3.3 tonnes per hectare in 2010.

Millet grains are highly nutritious with good quality protein, rich in minerals, dietary fibre, phyto-chemicals and vitamins. A cursory look at the proximate composition of various food grains would reveal the distinct nutritional superiority of small millets over major food grains such as wheat, maize and rice. This needs to be exploited both in terms of its health/nutritional benefits for alleviating the wide spread nutritional deficiency which is possibly the result of changed food habits and the shrunken food basket mostly consisting of rice/wheat diet patterns. Millet by its unique grain properties positions itself as a valuable food grain throwing considerable opportunities for diversification of its food use through processing and value addition. The regular use of millets can lead to significant health benefits and might help in reducing the incidence of cardio vascular diseases, constipation, diabetes mellitus and in improving the overall health of people. But, this to happen, the attitude of the people especially the urban dwellers to view millet as poor man's food must change. The lack of awareness of the health benefits of millet consumption among general public is the other reason for its under usage.

Millet is one of the oldest foods known to humans and possibly the first cereal grain to be used for domestic use. They have been in food use in India since 2500 BC. India has been the native home for little millet and kodo millet and were first domesticated in Indian sub continent. The antiquity of cultivation of these crops has led evolution of time tested millet based cropping systems and ethnic food culture thus ensuring stable well orchestrated food, feed and nutritional security. So, it is appropriate to term Small millets as Heritage Crops. These crops despite no support what so ever from the developmental agencies have survived and have withstood repeated onslaughts from so many competing crops. This itself is the testimony of their value to harsh farming situations and their resilience capacity to adjust to changing climates and yet producing reliable and dependable harvests. It is time we recognize the true value of these crops and sincerely promote their production and consumption and thus allow them to play their due role in contributing to national food basket.

Once Dr. Manmohan Singh, Honorable Prime Minister of India said “Rice grown under irrigated condition is facing the threat of water shortage. This is forcing a paradigm shift towards maximizing output per unit of water instead of per unit of land”. Conversion, Caultivation and pramotion of consumption of millets is the right answer of feelings of Honorable Prime Minister. In view of above facts all the millets are being compiled from different scatered literatures available. The short discription, nutrimental values and ethnomedicinal properties of different millets is being enumerated as below.

### 1:- ELEUSINE CORACANA (Linn.) Gaertn

(Synon: *Cynesurus coracanus* Linn.)

It is commonly known as Finger millet, ragi, nachani, mandua. It is 4<sup>th</sup> most cultivated millet, It is an erect, stout, annual grass. Leaves often over topping the stem; heaths compressed, loose. Spike 4-7 sub-erect, incurved. Spikelets awn-less. Caryopsis globose, dark brown. Phenology-September-October. It is cultivated for its grain.

Finger millet is an important coarse cereal of Indian Subcontinent and Africa and is cultivated in over 40 countries globally. India is the largest producer of finger millet accounting for 40% of the total global production from 25% of the total global finger millet area. The state of Uttarakhand is among the leading producers and consumers of finger millet. However, over the last few decades, the area and production of finger millet has declined steeply due to reduced household and local consumption. A major reason behind declining popularity of finger millet is poor *roti* making quality of its flour due to lack of gluten. Absence of gluten makes rolling out dough of finger millet into round shape difficult. The absence of gluten also prevents finger millet *rotis* from puffing up like *rotis* prepared from wheat flour. Popularly this problem is answered by adding wheat flour to the flour of finger millet in a fixed proportion to impart it elasticity; or by placing the finger millet dough ball between two plastic sheets and then rolling the dough ball out into round shape by gently moving the rolling pin over the plastic sheet (traditionally banana leaves were used in place of plastic sheets). A possible alternative to these methods is the incorporation of commercially available pure gluten into finger millet flour to impart it properties of wheat flour. The use of any such external supplement, however, seems unlikely to become popular among hill people who generally are wary of using external supplements of any kind in their food.

Finger Millet, also known as Ragi, is cultivated in drier parts of the world mainly in Asia and Africa. Ragi has a distinct taste and is widely used in Southern Indian and Ethiopian dishes. Ragi is a rich source of Calcium, Iron, Protein, Fiber and other minerals. The cereal has low fat content and contains mainly unsaturated fat. It is easy to digest and does not contain gluten; people who are sensitive to gluten can easily consume Finger Millet. Ragi is considered one of the most nutritious cereals. It has different names in local languages. It is known as Ragi in Telugu and Kannada, Kelvaragu/aariyam in Tamil, and Madua/Mangal in Hindi.

Ragi contains an amino acid called Tryptophan which lowers appetite and helps in keeping weight in control. Ragi gets digested at a slower rate thus keeps one away from intaking excessive calories. Also, fibers present in ragi give a feeling of fullness thus controls excessive food consumption.

Ragi is rich in Calcium which helps in strengthening bones. It is an excellent source of natural calcium for growing children and aging people. Ragi consumption helps in development of bones in growing children and in maintenance of bone health in adults. Ragi keeps diseases such as osteoporosis at bay and could reduce risk of fracture.

Finger Millet's phytochemicals help in slowing digestion process. This helps in controlling blood sugar level in condition of diabetes. In a study conducted in 2000, it was found that Finger Millet based diet helps diabetics as it contains higher fiber than rice and wheat. Also, the study found that diet based on whole finger millet has lower glycemic response i.e. lower ability to increase blood sugar level. This is due to presence of factors in ragi flour which lower digestibility and absorption of starch.

Finger Millet contains amino acids Lecithin and Methionine which help in bringing down cholesterol level by eliminating excess fat from Liver. Finger Millet also contains Threonine amino acid which hinders fat formation in the liver, which brings cholesterol level of the body down.

Ragi is a very good source of natural Iron. Ragi consumption helps in condition of Anaemia. Ragi consumption helps in relaxing body naturally. It is beneficial in conditions of anxiety, depression and insomnia. Ragi is also useful for migraines.



Ragi is rich in Amino Acids which are vital in normal functioning of body and are essential for repairing body tissues. Finger Millet contains Tryptophan, Threonine, Valine, Isoleucine and Methionine amino acids. Isoleucine helps in muscle repair, blood formation, contributes to bone formation and improves skin health. Valine is essential amino acid which facilitates metabolism, helps in muscle coordination and repair of body tissues. It helps in balancing nitrogen in the body. Another essential amino acid, not found in most cereals, is Methionine which is useful in various body processes, helps in eliminating fat from the body and is main provider of sulfur in body. Sulfur is essential for production of Glutathione body's natural antioxidant.

If consumed regularly, Ragi could help in keeping mal nutrition, degenerative diseases and premature aging at bay. Green Ragi is recommended for conditions of blood pressure, liver disorders, asthma and heart weakness. Green Ragi is also recommended to lactating mothers in condition of lack of milk production. Ragi is an extremely nutritious cereal and is very beneficial for maintaining a good health. However, its high in take could increase the quantity of oxalic acid in the body. Therefore, it is not advised to patients having kidney stones (Urinary Calculi). Ragi could be enjoyed in different forms and preparations. Ragi Roti, Ragi Dosa, Ragi Porridge, Ragi Upma, Ragi Cakes, Ragi Biscuits are few popular dishes of Ragi.

## 2:- PANICUM MILIACEUM Linn.

(Synonyms, *Leptoloma miliacea* (L.) Smyth, *Milium esculentum* Moench nom. Illeg., *Milium panicum* Mill. Nom Illeg., *Panicum asperrimum* Fisch., *Panicum asperrimum*). *Panicum miliaceum* is commonly known as proso millet, Broomcorn millet, common millet, broomtail millet, hog millet, red millet, white millet, china and Morha. It is 3<sup>rd</sup> most cultivated millet. It is a grass species used as a crop. Both the wild ancestor and location of the original domestication of proso millet are unknown, but it first appears as a crop in both Transcaucasia and China about 7,000 years ago, suggesting it may have been domesticated independently in each area. It is still extensively cultivated in India, Russia, Ukraine, the Middle East, Turkey and Romania. In the United States, proso is mainly grown for birdseed. It is sold as health food and due to its lack of gluten, it can be included in the diets of people who cannot tolerate wheat. Proso is well adapted to many soil and climatic conditions; it has a short growing season and needs little water. The water requirement of proso is probably the lowest of any major cereal. It is an excellent crop for dry land and no-till farming. Proso millet is an annual grass whose plants reach an average height of 100 cm. Like corn, it has a



C4 photosynthesis. The seed heads grow in bunches. The seeds are small (2-3 mm) and can be cream, yellow, orange-red or brown in colour.

Proso millet is one of the few types of millet not cultivated in Africa. In the United States, former Soviet Union and some South American countries, it is primarily grown for livestock feed. As a grain fodder, it is very deficient in lysine and needs complementation. Proso millet is also a poor fodder due to its low leaf stem ratio and a possible irritant effect due to its hairy stem.

In order to promote millet cultivation, other potential uses have been considered recently. For example, starch derived from millets has been shown to be a good substrate for fermentation and malting with grains having similar starch contents as wheat grains. It has been suggested that starch derived from Proso millet can be converted to ethanol with an only moderately lower efficiency than starch derived from corn. The development of varieties with highly fermentable characteristics could improve ethanol yield to that of highly fermentable corn. Since Proso Millet is compatible with low input agriculture, cultivation on marginal soils for bio fuel production could represent an important new market, for example for farmers in the High Plains of the US. The demand for more diverse and healthier cereal-based foods is increasing, particularly in affluent countries. This could create new markets for proso millet products in human nutrition. Protein content in proso millet grains is comparable with that of wheat, but the share of essential amino acids (leucine, isoleucine and methionine) is substantially higher in proso millet. In addition, health-promoting phenolic compounds contained in the grains are readily bio accessible and their high calcium content favor bone strengthening and dental health.

### 3:- PANNISETUM GLAUCUM (Linn.) R.Br.

Syn. *Penicillaria spicata* Willd., *P. typhoides* (Burm.) Stapf et C.E. Hubb. *P. typhoidium*, *P. americanum*, *Setaria glauca*, *S. lutescens*, *Pennisetum americanum*, *Alopecurus typhoides* Burm.f.

*Pannisetum glaucum* the fountain grass pearl millet is also commonly known as pearl millet, bulrush millet, cattail millet, candle millet, bajra, bajri, etc. It is most widely grown type of millet being grown in Indian sub continent and Africa since prehistoric times. India is the largest producer where as Rajasthan is highest producing state in India.

It is a tall, erect, stout, annual upto 2.5 m high. Leaves 15-60 x 1-4 cm, linear or linear-Lanceolate, Panicles cylindric, very dense, spike-lets deciduous, oblong, Caryopsis ovoid or ovovoid ellipsoid, smooth, free Phenology-September-October. It is cultivated for grains as well as fodder.

Bajra is very high in protein and energy content and is used in rotis (bread), rice, sprouted and porridge. Millets are a great source of starch, making it a high-energy food. It is also an excellent source of protein and fiber. It is said that the amino acids in the pearl millet are more easily digestible than the ones found in wheat. Due to essential nutrients such as methionine (an amino acid), B complex vitamins (niacin, thiamin and riboflavin), folic acid, lecithin, potassium, magnesium, manganese and zinc, millets are very effective in several roles. Niacin reduces cholesterol while magnesium is essential for maintaining good heart health, as it lowers blood pressure and reduces the risk of heart attacks.

Pearl millet is a rich source of phosphorus, which plays an important part in the structure of body cells. Phosphorus, found in pearl millets, is a significant component of several necessary compounds including adenosine tri phosphate (ATP). This element is also a crucial component of nucleic acids, which are the building blocks of the genetic code.

Phosphorus is a constituent of lipid-containing structures such as cell membranes and nervous system structures.

It had been proved that regular consumption of pearl millets help in preventing gall stones in women. They contain insoluble fibers which not only speed up intestinal transit time but also reduce the secretion of bile acids. Pearl millets are known to increase insulin sensitivity and lower the level of triglycerides.

Regular intake of millets provides protection against breast cancer in pre-menopausal women. Apart from that, it has also shown a considerable reduction in the occurrence of wheezing and asthma in children.

Millets contain an essential phyto nutrient, lignin, which is very beneficial for the human body. With the help of natural flora, lignans get converted to mammalian lignans and they fight against hormone-dependent cancers and reduce the risk of cardiac arrests.

Consumption of pearl millets helps in minimizing the risk of type 2 diabetes. Being a good source of magnesium, millets act as a cofactor in a number of enzymatic reactions.

#### **4:- SETARIA ITALICA (Linn.) P. Beauv.**

(Syn. *Panicum italicum* R. Br.) It is commonly known as foxtail millet, thinai, kang or rala, Kakun, Kangu Italian millet Kungu-Koro, Khukura, Kora-Okra. It is 2<sup>nd</sup> most cultivated millet. Foxtail millet is a fast-growing, erect, clump-forming annual grass with few, if any, side branches; it can grow from 30-150cm tall. The root system is dense, with thin wiry adventitious roots. The plant is one of the oldest cultivated crops, being in cultivation from about 5,000 BC in India and China, from where cultivation has spread to many areas of the world. It is still often cultivated for its edible seed in tropical to warm temperate areas. It also has a range of local medicinal uses. The plant is mainly grown for home consumption, but is also traded internationally on a small scale.

Seed are cooked. It can be eaten as a sweet or savoury food in all the ways that rice is used, or ground into a flour and made into porridge, cakes, puddings etc. The seed can also be sprouted before it is used, when it will become some what sweeter.

It is considered a nutritious food and is often recommended for the elderly and for pregnant women. Most cultivars are non-glutinous and are thus suitable for the diet of people with coeliac disease. It have the highest mineral content and 2<sup>nd</sup> highest production of all the millets.

The germinated seed of yellow-seeded cultivars is astringent, digestive, emollient and stomachic. It is used in the treatment of dyspepsia, poor digestion and food stagnancy in the abdomen. White seeds are refrigerant and used in the treatment of cholera and fever. Green seeds are diuretic and strengthening to virility.

Freshly prepared root decoction (10 ml.) mixed with a pinch of table salt (2 gm) is given at early morning in empty stomach to cure dyspepsia by the Lodhas. Tender stem is given as fodder to increase lactation of the cattle by the Santals. Fresh root paste (5 gm) mixed with the root paste of 'Gandhar' (*Paederia scandens*) and 'Sital' (*Sida cordata*) (3 gm and 2 gm each respectively) is given twice a day to cure blood dysentery by the Oraons.

### 5- SORGHUM BICOLOR (L.) Moench

*Sorghum bicolor* is commonly called as broom corn, guinea corn, jowar, Sorghum. It is an annual grass like other Sorghums, growing 6 to 15 ft although dwarf varieties are only 3 to 7 ft in height. The upper peduncle is normally 8 to 18 in long, topped by a branched inflorescence or panicle, from which the seed bearing 12-30 in long fibers originate which is branched towards the tip where flower and seed grow. There are about twenty eight accepted diverse species. Many species once considered a part of sorghum but now is considered better suited to other eighteen genera which is generally classified under two varieties, saccharine and non saccharine. The saccharine sorghum are not used for producing sugar owing to the difficulty of Crystallization. The sorghum seed yields a very white flour used for making bread and the grain is used for feeding cattle, horses and poultry.

The humble ancient grain, Jowar (Sorghum), which has been known to man since 3000 BC, it rapidly gaining importance for its nutritional and health benefits.

The use of this grain was restricted to animal feed. However, recent research has revealed that this grain has unique health benefits for humans.

When compared to rice and wheat, Sorghum has a higher content of calcium. Besides calcium, it also packed with iron, protein and fibre. The latest revelations in connection with this grain point to cardiac benefits. This benefit accrues from the presence of antioxidants in fairly large amounts. These antioxidants present in Sorghum are polyphenolic compounds. In addition to the antioxidants, the presence of sorghum wax, contributes to the cardiac benefit that this millet provides. The wax in this grain contains polyols, which help in lowering cholesterol levels. The rising incidence of Celiac disease has also led to new interest in this grain. Newer hybrid variety of this grain is being used to produce gluten free foods for such patients.

Sorghum does not contain gluten, which also happens to be the component responsible for the viscosity and elasticity of the dough. Thus, in the absence of gluten, when making food items from Sorghum flour, a batter of this flour is prepared. The batter of the flour goes into making bread, pizza base, pancakes and rotis.

Health food stores today stock the grain Sorghum as broken grain that can be made as porridges, either sweet or savoury, as one desires. The relatively bland flour made from Sorghum is also being added to other cereal flours to improve the overall nutritive value.

The superiority of this grain is not just from the point of view of well-being but also from the environmental perspective. The drought resistant nature of this grain along with its ability to produce a good yield with limited water supply is the need of the hour.

#### **6- ZEA MAYS Linn.**

Corn, commonly known as maize (*Zea mays* L.), is annual crop. Maize is also recognized by different synonyms such as zea, corn, silk corn etc. In Hindi it is called Makka and Barajovar. Maize is mother grain of Americans and is considered as the earliest cultivar of the new world. It is most widely distributed world's plant.

Multitudes of maize subspecies are identified and classified depending upon the extent of starch each have. Maize is a crop having short life cycle and requires warm weather, appropriate apprehension and management. It is valuable livestock feed, as human food and raw material for several industries.

Maize is native of South America but extensively cultivated in various other countries as well like India, Thailand, Pakistan and China and in several parts of Philippines. It is considered as staple article of food in some islands and provinces. It is widely grown in temperate and tropic regions with well drained and fertile soil.

Pollens and seeds are the nutritious and edible parts of maize. Seeds are consumed in raw and cooked form that serves as good source of carbohydrates. Corn contain vitamin B-complex such as B1 (thiamine), B2 (niacin), B3 (riboflavin), B5 (panto thenic acid) and B6 that makes it commendable for hair, skin, digestion, heart and brain. It contains vitamin C, A and K together with large amount of beta carotene and fair amount of selenium that helps to improve thyroid gland and play important role in proper functioning of immune system. It has higher content of protein and fat as compared to other cereals. Corn silk contains maizeric acid, fixed oils, resin, sugar, mucilage, salt and fibres essential for our diet. Corn syrup is useful in manufacturing of jams, jellies, and other sweets and as a additive for cane sugar and maple syrup.

Edible oils obtained from seeds are useful in salad and for cooking. Roasted seeds are used as coffee substitute. Phyto chemical secondary metabolites such as saponin, allantoin, sterol, stigmasterol, alkaloids, hordenine and polyphenols are found in leaves, seeds and corn silk.

From the ancient time corn has been used to pacify kapha, pitta, anorexia, general debilities, emaciation and haemorrhoids. It is a potent antioxidant that guards body from harming by free radicals responsible for cellular damage and/or cancer. It has the potential to alleviate pain and possess analgesic activity as well. Helping production of sex related hormones assemble it good for sexual health especially for men with erectile dysfunctions. It is believed to improve symptoms of rheumatism as B-complex is able to improve joint motility.

Major nutrient of corn silk is potassium that is powerful diuretic. In Europe and some other countries such as French, Spain, Greece including India; corn silk is used to conquer urinary tract infections and kidney stones. While in China it has been widely taken in case of fluid retention and jaundice. Corn silk improves blood pressure and support liver functioning as well as producing bile. Roots, leaves and corn silk as decoction are used for bladder while the decoction of cob as tea is used for stomach complaints. It act as a good emollient for ulcer, wound and swelling. In some places decoction of corn silk and parched corn is extremely useful in nausea and vomiting.

The oil present in corn (rich in embryo) is far and wide used for cooking and manufacture of soaps. Sticky gum contains dextrin used for sealing envelopes and labels. Corn starch is well recognized for its uses in cosmetics and pharmaceutical industries as diluents. Corn seeds are functional in making alcohol and stem fibres for manufacture of paper.

#### **7- ERAGROSTIS TEF (Zucc.) Trotter**

Syn: *Eragrostis abyssinica*, *Poa abyssinica*

Cooked seeds are consumed. It is used as a cereal for making bread and as a fermented food. "Enjera" is a fermented pancake like bread that is made from this grain in Ethiopia where it is a staple food. The bread is spongy, soft, thin and sour tasting. The seed is very small but easy to harvest. Protein content is around 13%. A casual on waste ground in Britain. Medicinal uses is not known.

#### **8- DIGITARIA SANGUINALIS Linn.**

It is commonly known as white fonio, black fonio, raisham, polish millet. Crab grass is the local name of *Digitaria sanguinalis*. It is an annual grass. The height of Crab grass is between 1 to 3 feet long. Crab grass develops several branching culms at the base, the lower branches of the culms tend to sprawl across the ground, while their upper branches are more erect. The culms are light green, terete and glabrous, although they are mostly covered by the sheaths.

The sheaths are light green, finely ribbed, shiny or dull and hairy. Leaves are soft and smooth, usually hairy near the base, 4-8 mm wide and with an open hairy sheath around the stem. Leaf blades 4 to 15 cm long and 4 to 12 mm wide. Leaf blade green to purple, both sides with silky, shiny hairs, often reddish with central strip and pale at the margin. Sheath green to reddish violet with long blister-like hairs, especially at the sheath base. Youngest leaf rolled. The central stalk of each raceme is light green, flattened and about 1 mm. across. There are many pairs of one-flowered spikelets along the length of each raceme; they occur along only one side of the flattened stalk. Each ovoid spikelet is light green to brownish green, flattened, and about 3 mm. long. The lemmas enclose a single developing grain. The blooming period occurs from mid-summer to early fall. Each grain is ovoid and flattened like the lemmas. The root system is fibrous, sometimes the nodes of the lower culms will form new fibrous roots.

Crab grass is mostly used as fodder. A fiber obtained from the plant is used in making paper. A decoction of the plant is used in the treatment of gonorrhoea. Seeds can be ground up and used as whole grain flour, fine white flour or semolina.

#### **9- ECHINOCHLOA ESCULENTA (A. Braun) H. Scholz**

*Syn: Echinochloa utilis* Ohwi & Yab., *Echinochloa frumentaceae* L., *Echinochloa crus-galli* var. *frumentacea* (Roxb.) Wight.

It is commonly known as barnyard millet, white millet, black millet, alkali millet, water grass, duck millet, Shirohie millet.

Japanese millet (*Echinochloa esculenta*) is an introduced, annual, warm-season grass that is grown primarily as forage and wild life habitat in the United States. It is a domesticated species derived from wild millet barnyard grass (*E. crus-galli*). It is robust with coarse, hairless leaves 4–20 in long. It has a thicker stem than most millets, grows 2–4 ft tall, with a brown to purple inflorescence. There are 5–15 racemes (stalked inflorescences) that curve inward, pressed closely to the main stem. The spikelets are awnless, slightly warty, with bristly nerves. It has a fibrous root system that can reach to 1½ ft deep.

Japanese millet can grow in flooded soils and standing water as long as a portion of the plant remains above the water's surface. It is better suited for colder climates and wetter soils than other annual summer grasses, however it has limited frost tolerance. It can grow at low and



medium altitudes It is adapted to soils with pH as low as 4.5 and salinity of 2,000–3,000 parts per million, but grows best in sandy–clay loams with pH values from 4.6–7.4.

Japanese millet is often grown as forage in the United States. It can produce up to 3,500 lb/ac of dried above ground biomass. The straw has greater protein and calcium content than rice, oat.

Japanese millet is a weed-suppressing cover crop that can grow up to 4 ft in 45 days. It is considered a good smother crop and has been shown to reduce the dry weight and the number of plants of yellow nut sedge (*Cyperus esculentus*) through root competition for nutrients and water. It is a good N scavenger and can be used as a fast-growing catch-crop. When Japanese millet is combined with cowpea, it can provide good weed suppression and improve the N fixation of cowpea.

Japanese millet is most often planted in the United States as feed for water fowl. The seed produced by Japanese millet is a preferred food source for ducks, doves and turkeys and is also a fair food source of pheas ant It can be planted around the edge of ponds and impoundments to provide good hunting habitat in shallow-water areas. For duck habitat, it is inter planted with corn to add dietary diversity near flooded areas. It is also eaten by a number of song birds such as sparrows, finches and cardinals.

#### **10- ECHINOCHLOA FRUMENTACEAE (Roxb.) Link**

Common Name: Japanese Millet Japanese millet is a robust, erect, clump forming grass producing culms 30 200 cm tall. The plant is sometimes harvested from the wild for local use of its edible seed. It is some times cultivated, especially in India and E. Asia for this seed, especially in areas where rice will not grow. It is also sometimes used in soil stabilization projects.

Japanese millet is an annual plant that can succeed in a wide range of environments from the temperate zone to the tropics. It can be found at elevations up to 1,500 metres. It grows best in areas where annual day time temperatures are within the range 25 30°C, but can tolerate 10 35°C. It prefers a mean annual rainfall in the range 500 750 mm, but tolerates 450 1,000 mm Requires a sunny position. Prefers a rich moist soil but succeeds in ordinary garden soil. Plants can succeed in soils with a pH as low as 4.5. Prefers a pH in the range 5.5- 6.5,

tolerating 4.8- 7.2. The fastest growing of the millets, it can produce a crop of seeds within 6 weeks of sowing in warmer areas.

Seed are cooked and used as rice. The seed can be cooked whole or can be ground into a flour. Usually eaten as a porridge. The seed contains about 72.5% starch, 3.12% fat, 11.8% protein, 2.65% ash.

The plant is useful in the treatment of biliousness and constipation.

As an erosion control plant it is used as a quick growing companion crop with perennial grasses and legumes and is especially suited to wet sites.

### 11- PANICUM MILIARE Lamk.

It is commonly known as kutki, little millet. It is an erect or geniculate, tufted, branched, glabrous, annual grass up to 90 cm high. Leaves 15-20 cm long, narrow, linear margin smooth or obscurely scabrid, flat, acuminate, base rounded and contracted; sheath loose, ciliate or with few bulbous-based hairs, ligule short, truncate ciliate. Spikelets solitary or in pairs, sub-turgid, ellipsoid or ovate-acute, glabrous, green or purple. Caryopsis ovoid. Phenology-June-October. In India the people have begun to look beyond the basic nutritional benefits of food to prevent diseases and enhance health. Cereals especially small millets provide an opportunity to improve the health of people, reduce health care costs and support economic development in rural, tribal and hilly communities. A study on nutrient composition, fiber fractions and value added products of Little millet (*Panicum miliare* L.) was undertaken to popularize millet consumption. Among the macronutrients, moisture ranged 5.77-11.38 per cent and the protein content ranged from 9.80 to 12.49. The amount of fat, ash, crude fiber and carbohydrates were in the range of 2.87-5.09, 0.98-4.78, 0.49-8.72 and 62.25-76.59g/100g respectively. Further the energy ranged between 332.26 to 382.41Kcal. Micronutrients (mg/100g) present were calcium (18-24), phosphorous (215-232), iron (3.0-10.5), potassium (125-131), sodium (6.3-7.8); zinc (2.63-4.20), copper (0.6-1.0) and silicon (0.07-1.97). Further, the total dietary fiber ranged from 9.22 to 17.46 out of which, neutral detergent fiber (35.50-46.12), acid detergent fiber (13.95-16.43g/100g) were important. Statistically significant differences were observed in treated samples.

Value added Indian products such as noodles, vermicelli, pasta products, pakoda, dosa, papad, biscuits, etc., were developed incorporating 30-100 per cent millet. These products

were well accepted (4.00 to 4.42) by judges. The study demonstrated that Little millet is not only a source of nutrients but also rich source of fiber. Hence, there is need to explore the opportunities towards development of diversified foods for household consumption to achieve nutrition security on sustainable basis.

### 12- *PENICUM SUMATRENSE* Roth ex Roem Schult

Syn; *Panicum miliare*, *Panicum attenuatum* It is commonly known as Kungu, Kutakii, Saanvaa Bare foot, Barega, Bilisamaihullu, little millet and sami.

*Panicum sumatrense* is perennial and grows in temperate and tropical climates. It grows upto one meter The origin of the plant is from China, India, Indonesia and grown in Burma, China, India, Indonesia, Malaysia, Pakistan and Sri Lanka.

It is an effective Acid Reflux, Ascites, Constipation, Diabetes, Dysentery, Gonorrhea, Indigestion and Obesity.

Action of Little Millet, is Effective Alexeteric, Alkaline, Antioxidant The nutrients are effective Carboxylic Acid, Cinnamic Acid, Flavonoid, Magnesium, Protein, Tannins and Zinc.

Taste of Little Millet is sweet, The information on herbpathy has been compiled from many sources. Some of it has not been verified or tested in a laboratory. Some of it is folklore. The data is intended to be information only. It should not be used for diagnosis or prescription.

### 13- *PASPALUM SCROBICULATUM* Linn.

It is commonly called as kodo millet, kodo, varagu rice. It is an erect or ascending, glabrous, annual grass. Leaves 10-20 x 0.3-0.8 cm linear-lanceolate, acuminate base keeled; sheath glabrous or hairy; ligule very short, membranous. Spilelets in two series, imbricate orbicular or sub oroid, plano-convex, glabrous, caryopsis biconvex, pale. It is common in paddy fields and distches. Phenology- August-September.

*Paspalum scrobiculatum*, Kodo millet (Tamil: Varagu), is an annual grain that is grown in primarily in India, but also in the Philippines, Indonesia, Vietnam, Thailand and in West Africa where it originates. It is grown as a minor crop in most of these areas, with the exception of the Deccan plateau in India where it is grown as a major food source. It is a very

hardy crop that is drought tolerant and can survive on marginal soils where other crops may not survive, and can supply 450–900 kg of grain per hectare.

*Paspalum scrobiculatum* var. *scrobiculatum* is grown in India as an important crop, while *Paspalum scrobiculatum* var. *commersonii* is the wild variety indigenous to Africa. The kodo millet, also known as cow grass, rice grass, ditch millet, Native Paspalum, or Indian Crown Grass originates in tropical Africa and it is estimated to have been domesticated in India 3000 years ago. The domestication process is still ongoing. In southern India, it is called kodo or kodra and it is grown as an annual. It is a minor food crop eaten in many Asian countries, primarily in India where in some regions it is extremely important. It grows wild as a perennial in the west of Africa, where it is eaten as a famine food. Often it grows as a weed in rice fields. Many farmers do not mind it, as it can be harvested as an alternative crop if their primary crop fails. In the Southern United States and Hawaii, it is considered to be a noxious weed. In India, kodo millet is ground into flour and used to make pudding. In Africa it is cooked like rice. It is also a good choice for animal fodder for cattle, goats, pigs, sheep and poultry. In Hawaii, var.*scrobiculatum* is found to grow well on hillside slopes where other grasses do not flourish. It has the potential to be grown as a food source on hillside farms. It may also have potential to be used as grass ties on hillside plots to prevent soil erosion, while also providing a famine food as a secondary purpose. It has been noted that it makes a good cover crop. Kodo millet has large potential to provide nourishing food to subsistence farmers in Africa and elsewhere.

Kodo millet is a nutritious grain and a good substitute to rice or wheat. The grain is composed of 11% of protein, providing 9 grams/100 g consumed. It is an excellent source of fibre at 10 grams (3738%), as opposed to rice, which provides 0.2/100 g and wheat, which provides 1.2/100 g. An adequate fibre source helps combat the feeling of hunger. Kodo millet contains 66.6 g of carbohydrates and 353 kcal per 100 g of grain, comparable to other millets. It also contains 3.6 g of fat per 100 g. It provides minimal amounts of iron, at 0.5/100 mg and minimal amounts of calcium and 27/100 mg. Kodo millets also contain high amounts of polyphenols, an antioxidant compound.

#### **14- SETARIA VERTICILLATA (Linn.) P. Beauv.**

**Syn. *Panucum verticillatum* Linn.**

It is commonly known Lapetua, barnyard millet, bristly fox tail millet. It is an erect or decumbent, annual grass up to 1 m high. Leaves 15-25 x 1-2cm, linear or linear-lanceolate,

acute, panicle spike-like, erect, straight or curved, cylindric, or oblong. Bristles rough, spikelets ellipsoid, Caryopsis ovoid, whitish-brown. Phenology-July-September. Common in most and shady places.

Seeds of the grass are used to make beer in South Africa and porridge in Namibia. They have been used as a famine food in India.

#### **15- UROCHLOA PANICOIDE S P. Beauv.**

Syn: *Urochloa panicoides* P. Beauv. *Varpubescens* (Kunth.), *Urochloa pubescens* Kunth. It is commonly known as Brachiaria, brown top millet, Guinea millet Liverseed grass. It is an erect or geniculately ascending tufted annual grass. Leaves semi-amplexicaul; sheaths loose, softly hairy; ligule a beard. Racemes second, 4-7 erect or spreading and spici form. Caryopsis minots, brown Phenology-August-October. Common along the margin of 'nullah' ponds and on the pasture grounds.

It is native to India. Introduced as a fodder grass, naturalized in Queensland and NSW. A weed of fallow land, roadsides, stockyards and waste places. May be a weed of lucerne and summer grain crops. Germinates after spring or summer rain.

It is palatable and nutritious when green, less palatable when dried off or frosted. Stock may be affected when the grass is wilted, or if the weather is overcast, or around stock yards where there is a high nitrogen content in the soil. Do not persist with heavy continuous grazing.

#### **16- COIX LACHRYMAL -JOBI Linn.**

It is also known as *Coix lachrymal* Linn. Commonly known as Jobs tear, Ghod-Jai. It is and erect, stout. glabrous, annual grass up to 2 m tall. Leaves 10-50 x 2.5 cm, linear lanceolate, acuminate, base cordate, margin spinulosely, scabrid. Spike numerous pendulous, axillary and terminal. Lower spikelet solitary, female enclosed in hardened polished nut like bract, yellowish-white or bluish-grey, which forms a bony involucre through the apex of which the pedicelled male portion emerges. Lodicule absent. Caryopsis ovoid or globose. Phenology-September-February. It is common in swampy places. Coix is the common name for the Chinese medicinal material. The entire coix plant and its seed pod are commonly called Job's Tears., the seed pod often has tear drop appearance. The seeds (caryopses) of *Coix lacrymajobiare* used as a source of food. The seed used as a Chinese medicinal ingredient is

called *yiwiren*. Coix was first mentioned in the *Shennong Bencao Jing* (ca 100 A.D.), mainly for use in treating people with stiffness attributed to inability to contract or stretch the sinews and for “bi syndrome” due to wind damp. In the *Jingui Yaolue* (ca 200 A.D.), the combination of coix and aconite was one of the recommended treatments for a syndrome of “thoracic paralysis.” The use of coix for stiffness in the limbs (inability to stretch or bend) is preserved to this day in Japanese practice (Kampo) remedies, a treatment for lumbar pain and stiffness due to myo fibrositis was described: 60 grams coix plus 30grams white atractylodes (*baizhu*), decocted and taken as a one day dose.

Coix Combination is known among Kampo practitioners as a remedy for early stage and mild forms of arthritis. In fact, one of the first Chinese herb formulas marketed in America direct to consumers was Coix Combination, sold in the early 1980s. It later became known as “Mobility 1,” part of the “Chinese Traditionals” line of formulas.

The fluid removing use of coix is represented in the Chinese medicated diet, such as in this recipe for treating ascites secondary to liver cirrhosis: Red kidney beans: 30 grams, Coix: 30 grams, polished round graine rice: 30 grams, Tangerine peel (*chenpi*): 3 grams. These ingredients are to be boiled to make a gruel that is taken in two meals during the day. There is also a recommendation for making gruel of coix with bush cherry seed (*yuliren*) for treating benign prosta tichypertrophy, a disorder which often causes urinary retention. And, as a tonic for alleviating a wasting disease (with loss of appetite, cough, fever and sweating, as occurs, for example, with tuberculosis), its recommendation is: Dioscorea (*shanyao*): 60 grams, Coix: 60 grams, Persimmon frost (*shibingshuang*): 24 grams, Dioscorea and coix are first cooked until completely softened; then the persimmon frost (which is the white material appearing on the surface of dried persimmons, being 95% sugar and containing some other ingredients from the persimmon fruit, considered good for nourishing the lungs) is dissolved in the gruel. This food is consumed in two portions for one day. Dioscorea, coix and hoelen are key ingredients of nutritive tonic food known as *Sishen Tang*, which is often cooked with pork or other meat to help those with gastro intestinal weakness. Coix is attributed a cooling property. Hence for treating stiff sinews, one would select the slightly warming herb Chaenomeles (*mugua*) when the problem is associated with damp cold, but would select coix when then problem is associated with damp heat.

In the book Chinese Medicinal Teas (10), a recipe for the wind damp syndrome with slight heat and swelling (which calls for use of an herb that is cooling and diuretic) is 30grams coix

and 10 grams siler (*fangfeng*). The cooling property of coix is a mild one which is eliminated by frying, a process used to make the herb better suited for spleen cold syndromes.

Coix has gained a reputation for beautifying the skin, so women in South east Asia have been encouraged to eat coix as a cereal grain, making it a regular practice to improve complexion. A highly concentrated extract of coix produced in Japan (where it is known as *hatomugi* or *yokuinin*) is promoted as a support for beautiful skin, hair and nails.

Coix has been included in medicinal formulas for treating skin diseases, such as acne and other swellings. A simple food recipe for treating acne is to combine 60 grams of coix with 30–60 grams of rice: cook and add sugar to taste. The application of coix for treating localized infections is generalized to treatment of suppurating abscesses of the lungs and intestines. A formulation based on this general indication is produced, combining coix extract with blood vitalizing and anti toxin herbs. Anti allergy properties have been suggested for coix, so that this seed is sometimes used in treatment of allergic dermatitis. Coix is also used topically in creams and lotions, said to clarify the skin, prevent skin aging and reduce blemishes.

It is said that the famous general Ma Yuen (A.D. 49) introduced the plant into China [today called Vietnam] from Cochin. It does not flourish so well here as it does in the Philippines, where the Chinese settlers make a kind of meal of the seeds, which is very nourishing for the sick. The un hulled corns are often strung by children as beads and priests are sometimes seen using the largest ones in their rosaries. The seeds are considered by the Chinese to be nutritious, demulcent, cooling, pectoral and the root is anthelmintic. Given either in the form of soup or congee gruel, it is highly recommended by native doctors. It is considered to be especially useful in urinary affections, probably of the bladder. A wine is made by fermenting the grain and is given in rheumatism. General Ma Yuen is said to have thrived on eating coix seed, so he enthusiastically promoted its cultivation in China. It is sweet, tasteless and slightly cold natured, coix can promote water metabolism, remove dampness, strengthen the spleen, relieve the stagnation syndrome of qi and blood, clear away heat and discharge pus. It is administered in the treatment of urinary difficulty, edema, diarrhea due to spleen deficiency, rheumatic arthritis, pulmonary abscess, pulmonary tuberculosis and cancer. Furthermore, coix may be used as a tonic for health care, suitable for people old and infirm, especially with stiff limbs. Often taking this herb will promote body vigor.



The diuretic aspect of coix is employed in a weight loss and lipid lowering tea made with oolong tea, coix, lotus leaves, alisma (*zexie*), crataegus (*shanzha*) and citrus (*chenpi*). Coix is also described as a food made with rice to form a gruel: "If the aged and the middle aged eat it regularly, they may enjoy the effect of preventing diseases, building up the body, retarding aging and prolonging life," indicated specifically for "senile edema, spasm of the muscles and tendons and numbness and pain due to wind dampness."

## DISCUSSION

The perusal of the enumerations reveals that the millets are very nourisher par excellence for total wellness and they should be conserved and the cultivation of the same should be promoted and encouraged by any means. These millets can be considered as popular Ayurvedic recipe to improve immunity, fight repeated infections, control stress and improve digestion, energy and nutritional status. It promotes physical and mental wellness, rejuvenates and delays aging

## CONCLUSION

From the literature study it is eventualized that the millets are worth while not only as food or medicine but even its waste after use has a number of unique importance for animals as well as industries. It has also been concluded that millets are not yet scientifically fully explored of for their composition and values and still requires researcher's attention so as to explore this unique group of plants for the new era of science.

## ACKNOWLEDGEMENTS

The authors are thankful Dr. S.P. Singh Principal Kisan PG College, Bahraich for facilities.

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