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Millets: Nutritional potential and Utilization

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Abstract
Millets are the world's sixth largest grain producer in Africa and Asia, these are rarely used cereals play a major role in the food security of millions of people. In addition to being rich source of nutrients, millet grain contains a lot of phytochemicals, especially lypheno-lic compounds. This review focuses on its history, consumption, types and several other uses of different types of millets. A wide variety exists in the phenolic content and antioxidant capacity of millet grains. In addition, millet grain phenolics, available, has biological properties that are resistant to several pathophysiological conditions and can act as natural sources of antioxidants in food and biological systems.

Keywords: Millets, history, types, consumption, ethanol

1. Introduction
The millets are minor cereals of the grass family, the Poaceae. They are tiny weeds, year after year, most of which are adapted to hot and dry climates and are characterized by their ability to live in less fertile soil (Shobana *et al*., 2013) [24]. Millets adjoin sorghum (Jowar), foxtail millet (Kakum), kodo millet (Kodon), pearl millet (Bajra), finger millet (Ragi), proso millet (Chena), little millet (Kutki), barnyard millet (Sanwa), and brown top millet (Gopalan *et al*., 2009) [13]. Research evidence suggests that whole grains and fiber consumption are associated with differences in BMI, buttocks length, total cholesterol, metabolic syndrome, mortality in cardiovascular disease, insulin resistance, and type 2 diabetes (Munter *et al*., 2007) [6].

Cereals are staple foods of most of the world's population. Grain provide the amount of energy, proteins, selected micronutrients and non-nutrients items in human diets around the world in both developed and developing countries (BNF, 2004). Cereal and cereal-based food products provide more than 56% energy and 50% of the protein consumed worldwide (BNF, 2004). The most important economically in the world are maize, rice, wheat, barley, sorghum, sorghum, oats and rye (Shahidi & Chandrasekara, 2013) [5].

The word millet is used for small sown economically sown grains belonging to the Poaceae family, but of different ethnicities and sectors. At the world's millet harvest conference about 90% is used in developing countries. Global millet production was about 27 million tons in 2009 (FAOSTAT, 2011). African and Asian countries have produced 56% and 41% of global funding, respectively. The contribution of millet grain to the world's grain production is about 1%, but its importance as a food crop in relation to the agricultural environment is very important (Shahidi & Chandrasekara, 2013) [5]. In addition, millet is often eaten as a whole grain product (FAO-STAT, 2011).

The cultivation of millet is occure in summer season. Generally, it is used for food, animal feed and fodder purpose in different parts of the world. It is estimated that about two thirds of the produced millet are used as food and some are used for planting seeds, animal feed, beer and poultry seeds (Shahidi & Chandrasekara, 2013) [5]. Sorghum and millets are often referred to as the grains of the poor and the crops of the poor because of their widespread use by economically disadvantaged sections of Asian and African countries. In addition, they remain under-utilized for grain even in agroecological systems where they grow due to their inclusion of mini-mal in commercial food systems, as well as the lack of re-research and production development processes (FAO, 1995) [9].

Table 1: Scientific and common names of major types of millets

Sr. No.	Scientific name	Common name	Major areas of production for grains
1	Pennicetum glaucum	Pear, bajra, cattail, bul rush, candlestick, sa nyo, Munga, seno	India, Western & Central Africa
2	Elusine coracana	Finger, ragi, African, rapoko, Hunsa, Wimbi, Koracan	India, Eastern & South ern Africa, Uganda
3	Setaria italica	Foxtail, Italian, German, Hungarian Siberian, Kangani, navane	China, India. Eastern Europe
4	Panicum milliaceum	Proso, common, hog, broom, samai, Russian, Panivarigu, panic	China, Russia, Kazhakastan, Ukraine, India, Japan
5	Panicum suma trense	Little, blue panic, heenmeneri	India
6	Paspalum scrobiculatum	Kodo, varagu, bastard, ditch, naraka, water couch, Indian paspalum, creeping pas palumm, amu	India
7	Echinochola crus-galli	Barnyard, Japanese, sanwa, sawan, korean, kweichou	India, China, Japan, Malaysia
8	Eragrostic tef	Teff, Abyssi nian lovegrass	Ethiopia, Eritrea, Australia
9	Digitaria exilis	Fonio, fundi, hungry, rice, acha, crabgrass	West africa, Sudan, Ethiopia, Nigeria, Mali

Source: adapted from (Shahidi & amp; chandrasekara, 2013; ICRISA T, 2012; Serrna-Saldivar & Rooney, 1995; Tylo r & Emma mbux, 2008) [5, 21, 19, 25].

History of millet

Millets are considered to be one of the oldest food crops grown from early human civilization and recent archeobotanical studies have shown that common millet was harmonize as a staple 10,000 years ago in North China (Lu *et al*., 2009) [17]. There are some proof in Northern China showing that noodles had been formulated by two types of millet, namely proso and foxtail millets 4000 years ago (Lu *et al*., 2005) [16].

Finger millet, one of the oldest plants in India is called "nrtta-kondaka" in ancient Indian Sanskrit literature, meaning "Dance Dance," also called "rajika" or "markataka" (Achaya, 2009) [2]. The first report of finger bean kernels comes from Hallur in Karnataka in India around 2300 BC (Singh, 2008) [14]. There is controversy about the origin of the finger millet, and there is speculation that the finger millets could have flown to India by sea from Arabia or South Africa or across the Indian Ocean on both sides (Achaya, 2009) [2]. Fuller (2002, 2003) [11, 13] reviewed archaeological work in India and elsewhere about the origins of Eleusine, and reports on its African origins and provides evidence of the language of the word "ragi" from the root of the root de`gi finger millet in many Bantu languages from the south of Tanzania and northern Malawi and some of its species on the Indian subcontinent. Fuller is skeptical about the many findings on fingerprints and reported that grain separated by Hallur (1000 BC), Malhar (800 BC-1600 BC), and Hulaskhera (700 BC) in India must be true (Fuller, 2003) [12]. Although Ragi (millet finger), jowar (sorghum), and bajra (pearl millet) are of African descent, they have long been bred in India (Achaya, 2009) [2].

Finger millet was a well-cultivated crop in different parts of India and was called nachni (meaning dancer) in the Maharastra region, “umi” in Bihar, etc. The grains would be gently dried (sometimes after germination and dried), the soil, purified. Pink flour (from the red finger millet) was eaten as a ball or gruel, made into sweets or salt. Finger millet were also popular as weaning foods (Achaya, 2009) [2]. Ancient Tamil literature from India, "Kuruntogai," calls the red finger millet "Kelvaragu". Sangam Tamil literature (600 BC - 200 AD), “Purananuru” depicts the drying, texture, and cooking of cereals. In ancient India, finger millet was given with a finger cooked in milk and given to honey by poets (Achaya, 1992) [2]. At that time and now it was used in Karnataka (Shobana *et al*., 2013) [24].

Millet types

Millet is a common term that includes a few grains of seeds. They are not of the same species or a single genus. The largest variety of grains according to the world production data is pearl millet (Pennisetum glaucum) which accounts for about 46% (Marathee, 1994) [18] followed by foxtail, proso and finger millet. There are other small millets available, kodo, small, Japanese barnyard, fonio, and teff millets. Table 1 lists the common names of millets used in different countries and their taxes. Usually, they have a small grain so they are separated like grains. The name millet is derived from the French word " mille " which means a thousand, which means that a handful of millets can contain thousands of grains (Ty-lor & Emmambux, 2008) [25].

Nutritional composition of different types of millet (all values are per 100 g of edible portion) (Gopalan *et al*. (2009) [13].

Table 2: Nutritional composition of different types of millet

Parameter	Ragi/finger millet	Proso millet	Foxtail millet	Little millet	Kodo millet	Barnyard millet	Pearl millet	Rice (raw) milled	Wheat
Moisture (g)	13.1	11.9	11.2	11.5	12.8	11.9	12.4	13.7	12.8
Protein	7.3	12.5	12.3	7.7	8.3	6.2	11.6	6.8	11.8
Fat (g)	1.3	1.1	4.3	4.7	1.4	2.2	5.0	0.5	1.5
Minerals (g)	2.7	1.9	3.3	1.5	2.6	4.4	2.3	0.6	1.5
Dietary fiber (g)	11.5	–	2.4	2.53	2.47	1.98	11.3	4.1	12.5
Carbohydrates (g)	72.0	70.4	60.9	67	65.9	65.5	67.5	78.2	71.2
Energy (kcal)	328	341	331	341	309	307	361	345	346
Calcium (mg)	344	14	31	17	27	20	42	10	41

Milllets are the well-balanced nutrient grain like other cereal grains (FAO, 1995) [9]. The major nutrients containing 60-70% carbohydrates, 7-11% proteins, 1.5-5% fat, 2-7% crude fiber,

Minerals and vitamins (Table 2). Millets are rich source of energy and is compared to other grains of grain. Apart from finger-bearing, some types of millet have a higher content fat from 3.5% to 5.2% compared to other grains (Shobana *et al*., 2013) [24]. Millets are rich in iron and phosphorus (Devi *et al*., 2011). In addition, finger millets have a high calcium content concentration of 350 mg / 100 g (FAO, 1995) [9]. In addition, millets are rich in many phytochemical chemicals contain many organisms that can provide good health effects to prevent and delay the emergence of non-communicable diseases (NCDs).

Consumption of millet in India

Reports from the National Nutrition Monitoring Bureau (NNMB, 2006) indicate that high consumption of sorghum is high in Gujarat (maize, pearl millet), Maharashtra (sorghum), Karnataka (sorghum) but almost none of the districts of Kerala, West Bengal, Orissa, and Tamil Nadu. rice forms a great base. Grain consumption in Gujarat and Maharashtra (200 and 132 g / CU (unit of use equals and 1 CU corresponding to the energy requirement of 2400 kcal / day for an Indian man doing sedentary work) was higher compared to that of Karnataka (75 g / CU / day) , Madhya Pradesh (32 g / CU / day), and Andhra Pradesh (16 g / CU / day) Tamil Nadu.

Although Indians continue to eat whole grains as a staple food that provides 70-80% of the total energy intake of most Indian foods (Gopalan *et al*., 2009) [13], millet consumption is very low compared to rice and as seen in our recent study on urban Indian food profiles (from Chennai Urban Rural Epidemiology Study (CURES) has shown that millet provides only about 2% of calories (6.7 g / d) (Radhika *et al*., 2011) [22], while about half of daily calories were obtained from pure grains such as refined white rice (253.4 g / s). per day) (Radhika *et al*., 2009) [22].

Pearl millet stover is an important fodder for livestock in the growing parts of India and Africa. Exports and the importation of pearl millet grains has little to do with the low demand, and / or unreliable availability of most of these for sale in international markets (Basavaraj *et al*., 2010) [3].

Feed and other uses

The widespread use of milllet grain in the USA and Canada is for food seeds and for birds. In the traditional growing areas of Africa, the East-Asia and the Indian subcontinent, millet is prepared in a variety of ways using flour /malted flour and grain sources. Cereals prepared from millets vary across continents, countries and regions in the same country as clude porridges, steam products, boiled and uncooked bread, products such as boiled rice, alcoholic and non-alcoholic beverages and snacks (Murty & Kumar, 1995) [20].

Pearl millet is very popular millet grain and utlized for multi-purpose for food and also for feed, fodder, fuel, and much more (Gulia *et al*., 2007) [14]. It has found that an excellent feed for birds, including dove, turkey, song-bird, ducks, and swine. Pearl millet grain also exist in the health-food outlets because of its gluten-free content (Gulia *et al*., 2007) [14].

Pearl millet is equal to or better than the normal soybean meal for broiler production and can be fed up to 10% of the portion without grinding (Davis *et al*. 2003; Hidalgo *et al*. 2004) [8, 15], thus reducing feed processing costs.

Broilers who ate portions of pearl millet pear were heavier and had a better rate of feed conversion than those fed corn, and mixed corn and sorghum. (Gulia *et al*., 2007) [14] studied good feeding of laying hens resulted in increased egg size and better feed conversion when pearl millet was placed in the maize area at 60% by weight.

Ethanol

The use of ethanol as an additive in the fuel produced will increase. UWu *et al*. (2006) found that the pearl millet fermentation rate was 30% higher than the maize fermentation rate, while the dried distiller grains containing solubles (DDGS) of the products produced were significantly higher than the protein. Low ethanol is produced by pearl millet fermentation, but due to its high protein content, the yield and value of DDGS are high, leading to higher economic recovery from pearl millet than maize. Studies show that pearl millet can add corn and sorghum to the production of ethanol. Ethanol production is a potential future market for grain, as few fermentation centers are available or built in Georgia (Gulia *et al*., 2007) [14].

Sorghum can be important in bioethanol and other industrial products. Bioethanol research has focused on enhancing process economics through crop selection, low-grade grain development and pre-processing of valuable products (Taylor *et al*., 2006) [26].

Conclusion

Millets are the most widely used grain in developed countries while serving as a staple food for millions of people in parts of Africa and Asia. The presence of high levels of dietary fiber and other healthy nutrients protected in all the preparations from the fingertips can help in the management of a healthy diabetic diet. Therefore, to enjoy the benefits of active ingredients, it is important to find processing methods with fingerprint fixes to get the highest health benefits. In addition to acting as a source of nutrients and micro-nutrients, such as some of the world's main grains, millets are rich in bioactive phytochemicals, especially phenolics. In addition, millets are a staple diet for celiac patients as they are gluten-free. Millet is a crop that adapts to climate change that can be grown all year round. It is well-known that chronic food and lifestyle-related diseases such as high blood pressure, heart failure, and type II diabetes pose a significant social and economic burden to the country. The phenolic content and composition of different millet cereals and the available evidence of beneficial health outcomes emphasize their importance as an effective dietary supplement in reducing non-communicable diseases (NCD) and improving health.

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