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A Review On: Importance of Millets as an Emerging Nutraceuticals on People Health

[1]Shabnam, [2]Shalu Kumari, [3]Jyoti Gupta.

[1.] Shabnam, Student of bachelors of pharmacy, School of Pharmacy, IEC University, Baddi.

[2.] Assistant Professor, School Of Pharmacy, IEC University, Baddi.

[3.] Associate Professor, Head of Department, *IEC School of Pharmacy. IEC University, Baddi.

ABSTRACT:

Millets are coarse grain (mota anej) which is also ancient forgotten grain. Millets were traditionally grown and colon on the Indian". Subcontinent for the last 5000 years. They contain high nutritional value and are rich in proteins, vitamins, minerals and fibres. Millets require little water, inexpensive and ground fertility. They have long enjoyed the tay of "(poor men's food grain" due to its sheer affordability. From 1960-65 (Green Revolution) fill the end 2000 they were completely forgotten. Due to the introduction of hybrid, wheat and rice. This demands declined drastically and they started to become extinct. They have now made a comeback and are being called the new suffered. One food that causes many chronic diseases, like diabetes (or pass Obesity).

Keywords: Millets, proteins, food grain, hybrid, diabetes.

INTRODUCTION:

Millets are an important cereal and ranked 6th in term of the agricultural production worldwide. These are small seeded grasses that are hard in nature. Their production is very good at dry zones where the water content in soil and moisture content are not at much level countries which are in dry zone area i.e. Africa grow nearly 55-59% of the total global production. South Asian countries like China India and other countries becomes second largest producer of the total production of millets[1].

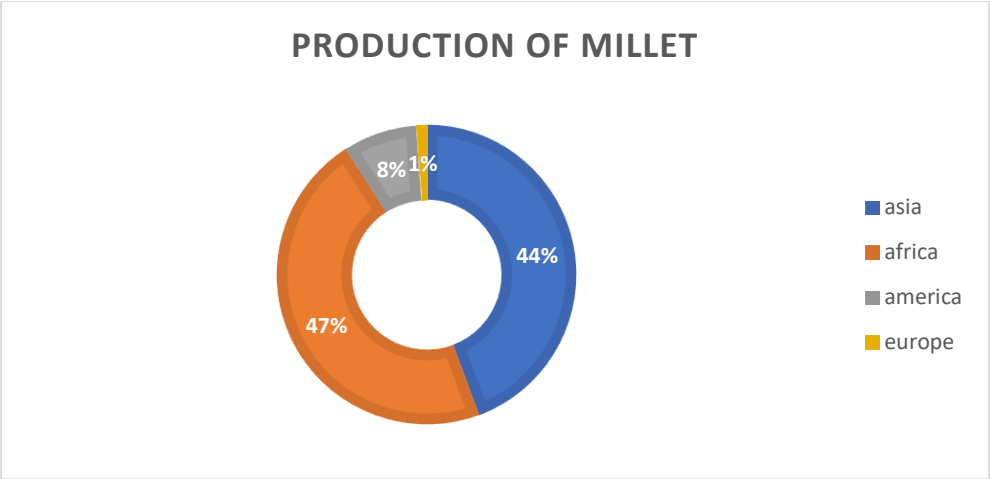

Figure: 1 (Production Of Millets)

Millets are stated as small millets comprises FINGER MILLET (Eleusinian coracana) ,FOXTAIL MILLET (setariaitalica) , PROSO MILLET or WHITE MILLET (Panicum miliaceum), BARNYARD MILLET (Echinochloa spp.), KODO MILLET (Paspalum scrobiculatum), and LITTLE MILLET (Panicum sumatrense) .

TYPES OF MILLETS

- **Sorghum:** A staple crop of dry zone i.e. of India and Africa .persons which have gluten insensitivity and celiac disease because it is gluten free and very safe for these types of patients. So, Sorghum used as Wheat replacement for bread and pastas. It also helps in weight loss when we compare them with rice, wheat and jowar because of having low level of calcium .it also contain rich amount of iron and protein fiber because of gluten free nature sorghum is used as the wheat replacements of for persons who can't tolerate wheat products[2].
- **Finger millet:** Another but the most nutritious cereal and a good calcium source which helps in bone strengthening and reduces risks of bone fracture. These also can reduce risk of Anemia which is caused due to deficiency of iron in the body as finger millet is very rich the iron quantity so can be used in the diets of persons which having Anemia and other iron deficiency diseases. It also contain store for nutrients like proteins, amino acids, minerals and vitamins and having rich fiber content, it is good laxative and helps to prevent constipation. It is a good food for the lactating and pregnant women because of having high level of calcium in it. It also helps in different disease conditions like blood pressure, heart problem, asthma and also for diabetes because it slows digestion and slow release of glucose in blood. (O.S.K.Reddy, 2017)
- **Pearl millet**: It helps in reduce the risks and episodes of migraine, occurrence of gall stone because of having high fiber content and magnesium. The insoluble fiber present in pearl millet helps in reduction of excessive bile in our system, because excessive bile can leads to gall stone.
- **Kodo millet:** It is a traditional food which closely resembles the rice and helps to use in weight loss. Kodo millet also helps in reducing the joint and knee pain and helps in regularizing the menstruation in woman.

- **Proso millet:** It is very useful in preventing of pellagra conditions which is caused due to niacin. A skin disease which causes the skin to become dry, scaly and very rough it consists of protein and niacin (vitamin B3).
- **Foxtail mllet:** Without altering the body's metabolism, foxtail millet aids in the continuous release of glucose. Due to its high magnesium content, foxtail millet is renowned as a heart-healthy diet and helps to lower the prevalence of diabetes in society.

Millets plays a useful role in classical and cheap as well as effective diet in many regions especially in poor and developing countries. Millets are nearly 3 to 5 times more nutritious than widely used rice and wheats. Because millets can be used for many purposes like animal feeding, as 349utraceuticals in comparison with wheat and rice. Millets having nutritional as well as used as managing health problems like diabetes mellitus, hyperlipidemia etc.[2]

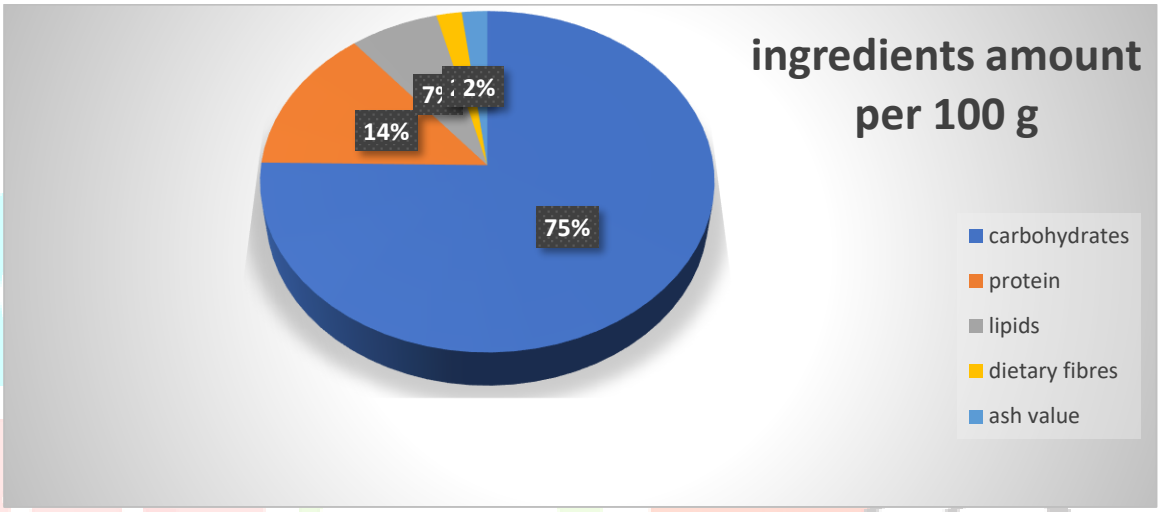

Figure: 2 (Ingredients Amount per 100g)

The quantity of carbohydrates, proteins, dietary fibers, minerals and vitamins is very rich. Carbohydrate quantity is not so high but the protein is very much comparable with other cereals .if we talk about fat quantity then foxtail and barnyard millet top the list among other forms of millets .millets are also rich in the inorganic matter for example finger millet is known as the richest source of calcium.

- **Carbohydrate**

The millets carbohydrates in the milled grain consists of free sugar (2-3%) ,non starchy polysaccharides (15-20%) and starch (60-75%) . Among the free sugar, glucose, fructose, sucrose are prominent then on starchy poly sachharides, which used as dietary fibre comprises of cellulose, hemicelluloses. It also contains amylase and amylopectin in ratio 25:75 as contained in other cereals also. Starch granules are compacted in the cellular matrix and a major portion of endo sperm is of vitreous nature.[3]

- **Protein**

Millets are comprised of having high level of albumin, globulin. Cross linked promalin, glutelin etc types of protein fraction. The percentage of total protein that is promalin varies from 22.8 to 31.7 in pearl millet, 24.6-36.2 in finger millet, and 47.6–63.4% in foxtail. In comparison to foxtail (6.7% of total protein), finger millet

has a greater glutelin content (12.4–28.2% of total protein). In these millets, the albumin + globulin fraction ranges from 11.6 to 29.6%.[4] Table 3 lists the essential amino acid content of millets. Pearl millet has the highest average protein content of all millets (6.9–12%), whereas fonio and finger millet typically have the lowest protein levels (5.1–10.4, 4.9–11.3%, respectively). In every 100 grammes of protein, finger millet has 5.5 g of lysine. Lysine is abundant in teff (2.0-4.0/10 g protein) and Kodo millet (3.0-3.5/100 g protein). The least balanced necessary amino acid content is found in proso and Japanese millets. The true digestibility of millet proteins ranges from 95 to 99.3, with common millet having the highest true digestibility. The biological value and net protein utilization of pearl millet protein are higher than those of minor millets (BV = 48.4-56.5 and NPU = 46.3-54.5), although the digestible energy of minor millets is higher than that of pearl millet (95.6-96.1).[5]

- **Lipids**

The fat content of the millets ranges from 1% to 5%, with finger and Kodo millet having the lowest percentage and pearl, foxtail, and proso millet having the highest percentage. Both the endosperm and the bran contain fat in varying amounts. The fat typically contains linolenic acid and more than 60% unsaturated fatty acids. [1] 1.8–3.9% of the lipid content of common millet. Approximately 24% of the total grain fat is present in the embryo. According to the fatty acid profile, there are 78–82% unsaturated fatty acids and 17.9–21.6% total saturated fatty acids in the sample [1]. Lipids were found to be triacylglycerols and rest contains a small fraction of mono diacyl glycerol's, free fatty acids and sterols. The major phospholipids present in the millet seed is lysophosphatidyl chorine whereas lysophosphatidylethanolamine are present in small quantity.

- **Vitamins**

The millets are abundant in vitamins B-complex and E. (except Vitamin B 12). 10.88 mg of niacin are present in total. But just 13% of the total niacin contained was niacin was extractable in cold water. Millets' mature grains have low quantities of vitamin C. Millets have a lower tocopherol concentration than soybean and corn oils. Millet seeds have very little -tocopherol and most of the tocopherol are found as -isomer. Compared to other tocopherol, -tocopherol has an extremely high vitamin activity. Tocopherol vitamin E activity is 10% that of tocopherol. The common millet kernel is used to extract the unrefined fat, which was discovered to have Vitamin E and Vitamin A equivalents (8.3–10.5 mg).

- **Minerals**

Table: 1(Composition of minerals present in different types of millet (mg/100g)

minerals	*pearl*	*finger*	*foxtail*	*little*	*proso*	*Kodo*
K	440-442	408-570	250-400	129-370	250-320	144-170
Na	10.0-12.0	7.0-11.0	4.6-10	6-8.1	8.2-10	4.6-10
Mg	130.137	110-137	100-130	120-133	117-153	130-166
Ca	10.0-46.0	240-410	10.0-137	12.0-30.0	20-23	10.0-31.0
P	350-379	240-320	270-310	251-260	230-281	215-310
Mn	1.15-1.8	5-5.5	2.19-26	1.0-20.0	0.6-1.81	1.10-2.9
Zn	2.95-3.1	2-2.3	2.14-9	3.5-11	1.4-2.4	0.7-1.5
Cu	0.62-1.06	0.4-4	1-3.0	1.0-4.0	0.83-5.8	1.6-5.8
Fe	7.49-8.0	3.9-7.5	3.26-19	13-20	4.0-5.2	0.7-3.6

SOURCES:

Varriano-Marston and Hoseney, (1980),Lorenz et al., (1976), Serna-Saldivar et al., (1991),Serna-Saldivar and Rooney, (1995), Pore, and Magar, (1979), Chung, (1991), Barbeau, and Hilu, (1993), Chavan, (1989), Hulse et al.,(1980),

The quantity of minerals content i.e. of calcium and manganese is too high compared with sorghum. *(Josheph et al. 1959)* , conducted studies on replacement of rice – based diet to finger millet , in the diet of 9-10 years oral girls showed that it improved calcium retention along with maintaining positive nitrogen balance . Thus, finger millet could be used in place of rice to overcome the calcium deficiency.[8]

Millets are also very rich in phosphorus which is very essential component for energy production in the body. Studies shows that a well cooked cup of millet gives 26.4 % of daily need of magnesium and 24 % daily need for phosphorus. It is very useful for patients that have cardiovascular disease because it is a good source of magnesium which increases insulin sensitivity and lower triglycerides.[7]

- **Nutrients bioavailability**

Bioavailability of nutrients present in millet is low due to the presence of anti-nutritional factors. Such as phylates and tannins .because these are the substances which affect the bioavailability of minerals. Rao et al. 1983 studied the absorption pattern of iron in humans from millets and compared with that of rice and wheat. They found that absorption from millet was lower than from rice and wheat. In vitro studies on commonly cultivated or highly pigmented finger millets showed poor bioavailability of iron due to their tannin content. Iron content can be enhanced by the reduction of tannin content from millets.[9]

- **Fibre**

According to *Kamath and Belavady*, total dietary fibre in pearl millet and finger millet was higher than it was in sorghum, wheat, and rice (8.3%), at 14.2%, 17.2%, and 18.6% respectively.[10] Water-soluble non-starch polysaccharides made up 0.66% of the grain weight in pearl millet, while water-insoluble non-starch polysaccharides made up 3.88%. According to Muralikrishna et al., hemicelluloses B in tiny, Kodo, and barnyard millets are made up of hexose, pentose, and uronic acid, whereas hemicelluloses A are a non-cellulosic beta-glucan.[11] According to Wankhede et al., the pentosans content of finger and foxtail millet was 6.6 and 5.5%, respectively. Dietary fiber's health advantages are associated with lower blood cholesterol, blood sugar, and regular bowel movements. Millets are abundant in health-promoting fibre. Polyphones, phytosterols, phytoestrogens, lignins, and phytocyanins, among other photochemical. Due to their roles as antioxidants, detoxifying agents, and immunological modulators, these substances guard against age-related degenerative diseases (such as CVD, diabetes, cancer, etc.).[12]

MILLETS AS NUTRACEUTICAL

Bioactive compounds from food sources which having a protective effect against degenerative disease in its isolated form are termed as 352utraceuticals. The 352utraceuticals that are mainly present in millets are phenol acid, flavonoids, carotenoids and tocopherol, arabinoxylans, phytic acid, phytosterols.

- **Phenolic acids**

With one benzene ring and a carboxylic acid activity, phenol acids are aromatic chemicals. Many of the phenol acids are either benzoic acid (C6-C1) derivatives or structure), and they can be split into two main groups: derivatives of hydroxybenzoic acid and derivatives of hydroxycinnamic acid. Protocatechuic, vanillic, syringic, and gallic acids are hydroxybenzoic acid derivatives. These substances are often found in their bound state as parts of intricate structures like lignin and hydrolysable tannins. Hydroxycinnamic acidP-coumaric, caffeine, ferulic, and sinapic acids are oxycinnamic acid derivatives. They are primarily found in bound form, connected to structural elements of the cell wall proteins, cellulose, lignin, and other materials via ester linkages. Ferulic acid, vanillic acid, caffeine acid, syringic acid, and p-coumaric acid are among the prevalent phenol acids present in finger millet grains[13].Acid ferulic [Figure 1b] One of the most prevalent phenol acids discovered in finger millet grains is (trans-4-hydroxy-3-methoxycinnamic acid).[14] It is prevalent in the cell walls of the aleuronic, pericarp, and embryo of different grains, but it only appears in trace levels in the starchy endosperm.

PHYTOSTEROLS

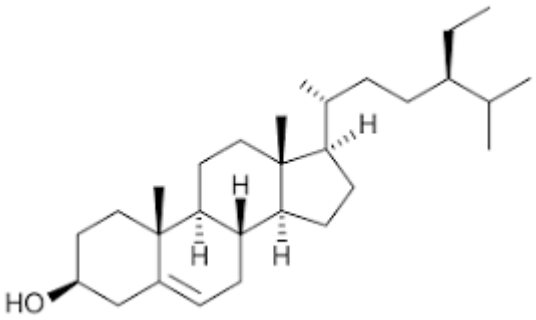

Figure: 3 (Structure of Phytosterols)

A desmethylsterol, that share a common ring with cholesterol structure are phytosterols. They are essential structure and functional component of plant cell. Due to its structural similarities with cholesterols they show significant lowering in the serum cholesterol level by altering the rate of uptake of dietary and endogenously produced cholesterol. According to experimental data phytosterols ester have ability to reduce the blood serum LDL .and cholesterol up to 14 % but no effect on HDL level. The presence of sterol reduces absorption of alpha and beta carotene and also vit E. But its daily consumption reduces risk of heart diseases up to 40 %. Finger millet contain mac quantity of phytotsterolsapprox.. 0.149% on seed weight basis. Whereas, sorgum and corn was reported to be 0.5 mg/ g and 0.9mg/g.

- **Catotenoids and tocopherols**

Carotenoids are well known for their pro vitamin A activity. However < carotenoids are among those important compounds which protect against various disease because of having properties of antioxidants, carotenoids structurally consist of iroprenoids unites with long polyene chain containing 3 to 15 conjugated double bonds. The position of double bond determines their absorption spectrum; carotene is cyclized product where cyclization exists at one or both ends, while xanthophylls are formed on addition of oxygen. Some modification based on isomerization, chain elongation, or degradation also occurs. Recent report by Asharani et al. have shown that values for total carotenoids content in edible millet flour varied from 78 to 366 µg/100 g with an average of 199, 78, 173, and 366 µg/100 g in finger, little, foxtail, and proso millets, respectively.[15] The carotenoids values obtained for millets were are comparable with the carotenoids content of wheat (150–200 µg/100 g) and sorghum (180–230 µg/100 g) but significantly less than maize (1800–5500 µg/100 g) and their varieties (2400- 3200 µg/100g).Vitamin E is a fat soluble components widely found in nature consist of a family of eight different molecules. Both tocopherol and tocotrienols have four variants, namely alpha, beta, gamma and delta. This variation is due to the number of methyl groups present in the chain. Vitamin E analyzed by HPLC indicated a higher proportion of gamma and alpha tocopherol and lower level of tocotrienols in the millets. Vitamin E acts as antioxidants, anti inflammatory, decreases superoxide production in mitochondria and anti atherosclerotic compounds.

PHYTIC ACID

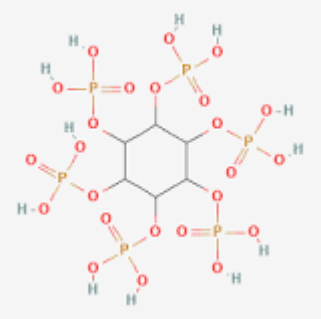

Figure: 4 (Phytic Acid)

A compound whose chemical name is myoinositol 1, 2, 3, 4, 5, 6 hexakis-dihydrogen phosphate. its concentration in food ranger from 0.1 to 6.0% Reddy et al.lorenz reported the phylate content of common millet varies range between 170 and 470 mg/100g whole grain and also shown 27-53% reduction in phylate content on dehulling, dehulling causes phytic phosphorus content to decrease by 12 % in common millet, 39 % in little millet, 25 % in Kodo millet and 23 % in barnyard millet.

- **Arabinoxylans**

It a class of hemicelluloses which are found as components of plant cell wall both primary and secondary cell wall, contain a chain of 1,4 linked xylems with 2,3 linked arabinose residue .[17] These components as non-digestible are regarded as dietary fibers. Dietary fibre provides bulk to the diet and has a positive effect on cholesterols regulation. Xylooligosaccharide content in finger millet brain was estimated at level of 15.60 % wheat bran at 40 % and corn bran 9.33%[18]. Studies have shown positive effect of dietary fibers on chronic diseases such as type II diabetes, cardiovascular disease and gastrointestinal cancer on the basisi of large scale prospective studies. Arabinoxylans undergo formation of arabinoxylooligosaccharides and Xylooligosaccharide which shown to have periodic effect in the colon of humans and animals through selective stimulation of beneficial intestinal micro biota.

HEALTH BENEFITS OF MILLET

- **Millets in obesity**

A problem which is a trigger of generation of several chronic disease such as diabetes and cardiovascular disease .Recent studies shows that intake of high dietary fibre decreases the incidence of obesity (Alfieri et al, 1995). Foods that are rich in dietary fibre improves the bowel function and slows the process of digestion and absorption, thereby reduce risk of chronic disease (Ali et al. 1982) . Millets have a dietary fibre level of 22%, which is higher than the contents of other cereals like wheat (12.6%), rice (4.6%), and maize (13.4%). According to Chethan et al. (2007), finger millet grain contains 1.4% soluble dietary fibre and 15.7% insoluble dietary fibre. According to Shobana et al. (2007), finger millet contains 2.5% soluble dietary fibre, 19.7% insoluble dietary fibre, and 22.0% total dietary fibre. Dietary fibers are divided into soluble and insoluble types, as is common knowledge. Obesity is now a prevalent issue that is linked to a number of

other disorders, including diabetes, high blood pressure, and cardiac issues. According to studies, eating foods high in fibre helps to improve gastrointestinal function. They decrease the prevalence of obesity by enhancing the body's digestion and absorption, lowering the likelihood of developing chronic illnesses. Millets aid in controlling weight and lowering obesity in addition to satisfying hunger. Millets' high fibre content reduces issues including constipation, gas, bloating, and cramping in the stomach. Good digestion and absorption prevent the recurrence of gastrointestinal conditions such colon cancer and ulcers (O.S.K. Reddy, 2017)

- **Millet in diabeties**

Sumanthi and Kumari (2002) studied the effect of consuming finger millet n hyper glycemiain non-insulin-dependent diabetes mellitus (NIDDM) , researchers found out that glycolic index of finger millet was lower than that of rice and wheat. Due to the presence of poly phenols in finger millet results into decrease in glycolic response and also reduces the starch digestibility and absorption hence decrease glucose level in the systemic circulation. Finger millet polyphones (FMP) were extracted in acidified methanol and then investigated for their ability to inhibit the activities of porcine pancreatic α-amylase and rat intestinal α-glycosidase. This shows that these phenol have huge potential for managing hyperglycemia.[19] Tadera et al. reported that the starch digestive enzymes were inhibited by naringenin, kaempferol, luteolin, apigenin, (+)-catechin/(–)-epicatechin, daidzein, and epigallocatechin gallate which are present in millets. ICMR in 2010 measured Glycemic index (GI) of sorghum based foods in collaboration with Indian Institute of Millet Research. In which the outcomes are shows that sorghum based food reduce postprandial blood glucose level due to high fibre content by reducing enzymatic hydrolysis of complex carbohydrates.

- **Millets in cancer**

Millets are rich in phenol acids, phylates and tannins which act as ant nutrients and reduce risk of colon and breast cancer and other type of cancers initiation and progression. *(Chandrasekhar A et al., 2011*). Linolenic acids which have antitumor activity are also present in Millets. The phenols and tannins present in sorghum have anti carcinogenic properties *(Grimmer et al., 1992*) and can act as against human melanoma cells .millets contain many antioxidants that can neutralize free radicals, which can cause cancer and also clean up other toxins from your body .

CONCLUSION:

In today’s world nearly maximum population are facing the low nutritional diet problem. this is because of our change in the daily lifestyle as well as due to advancement on modern day to day life . the aim of study conducted over millet is to recognize the potential of millet efficiency as a part of food . studied conducted in the world for the malnutrition stated that children’s and infants are very malnutritious due to heavy nutrition loss and people have less money to buy food in poor countries so, millets can be a super food for these countries due to its cost effectiveness . of the total millet produced is about 90 % in the world is consumed by developing countries and about two third of millets produced are consumed as food . Nutritive

potential of millets in terms of protein, carbohydrates, and energy values are comparable to the popular cereals such as rice, wheat, and barley. Some epidemiological studies have shown that regular consumption of millet grains and their products is associated with reduced risk of developing chronic diseases such as diabetes, cardiovascular disease, cancers, and all-cause mortality. Millets have a potential for the preparation of healthy foods. Millets have antioxidants, which are substances that may protect your cells against the effects of free radicals.

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