

FORGOTTEN SUPERFOOD: MILLETS.

Saurabh D Patil

Maharshi Markandeshwar Medical Sciences
and Research, Sadhopur, Ambala.

Email: sdsaurav53@gmail.com.

Mobile no. 9860043078

Swati Patil

Rashtrasant Tukdoji Maharaj University,
Nagpur.

Email: sawatihime@gmail.com

Mobile no. 8830532547

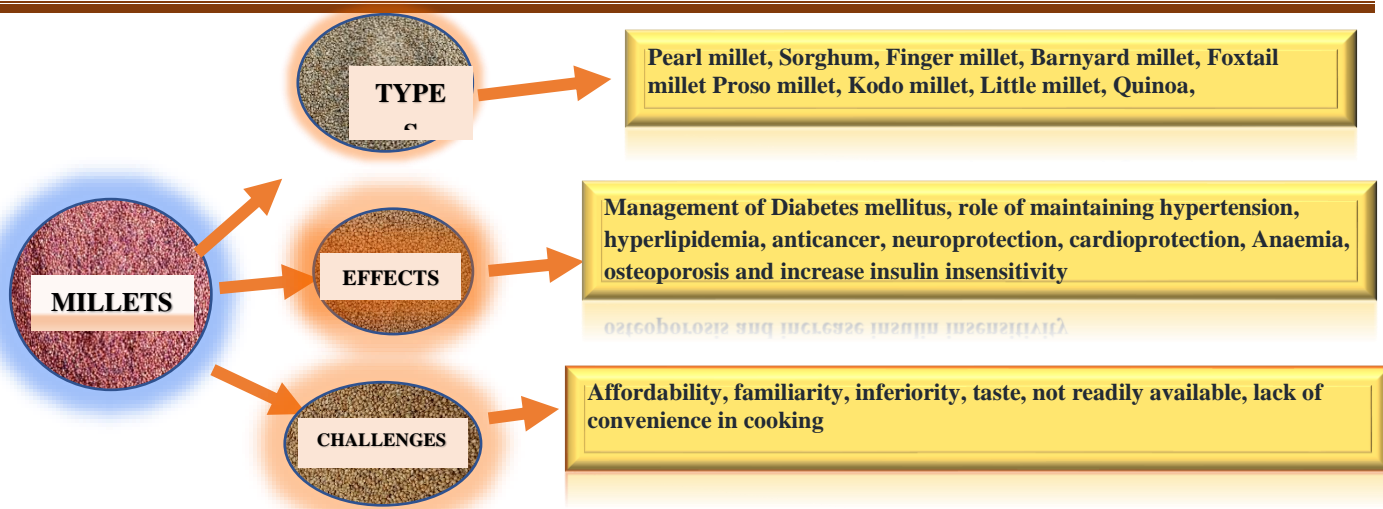
Nishikant Raut

Rashtrasant Tukadoji Maharaj Nagpur
University, Nagpur.

Abstract:

Millets are widely cultivated in the tropics and subtropics of Asia and Africa. Millets can grow in the harshest of environments such as dry and arid, at high altitudes and requires less amount of water. Millets are rich in protein and fibre. They are gluten-free so can be recommended to patients having gluten allergy and celiac disease. Millet has a high amount of macronutrients such as calcium, sodium, phosphorus and magnesium. It also contains B-complex vitamins and micronutrients such as folate, copper, zinc and iron. It has high folate content that makes it a biofortifier for the populations who have folate deficiency anaemia. Millet has a very low glycemic index and can be used in the management of diabetes mellitus. It has a Renin-Angiotensin and Aldosterone System (RAAS) inhibitory effect that maintains blood pressure. Consumption of millet has a protective effect on cardioprotection, neuroprotection and a role in preventing colon cancer and breast cancer also manages hyperlipidemia. High calcium concentration and minerals help in fighting osteoporosis. There are some challenges present in the consumption of millet viz affordability, costing, inferiority, taste, not readily available, lack of convenience in cooking and after-effects of the green revolution. Despite these challenges, people are now understanding the health benefits of millet and society is restarting to consume the millet-based diet. Due to their nutritional value, presence of essential vitamins, minerals, cancer-fighting chemicals, cardioprotective, neuroprotective, hyperlipidemia and diabetic protection property, they are sometimes also considered as superfoods.

Keywords: Millet; Renin Angiotensin and Aldosterone system (RAAS); superfoods; biofortifier; glycemic index



Forgotten superfood: millets.

Introduction:

Millets are small-seeded crops that are cultivated mostly in African countries and South Asian Countries. Millets are a gluten-free crop, so their demand has increased in North America as well as in European countries.¹ Millets are widely used in the tropics and subtropics of Asia and Africa, particularly in India, Nigeria, and Mali.² Millets are sustainable food in the food economy, and in the near future, it will become the readily available food because of their ability to grow in the harshest of environments. Many studies have been done that showed the nutritional, hypoglycemic, and antihypertensive properties of millets. This review article is going to elaborate on the properties of the millets and can we call millets as a superfood? The glycemic index of the millet is low and ranges between 42.7 to 58.3, which is considered one of the best foods in the management of diabetes. One-third population of the world has their staple diet as millet and it ranks as the sixth most important cereal.³

Types of the millets :

Millets as a Nutri-cereal: What Are They?

Millets are rich in protein and fibre. Some essential fatty acids, and trace minerals such as potassium, zinc, magnesium, calcium and iron are also present in the millet. There is also an abundant amount of B-complex vitamins found in millet. Millet also has complementary effects in preventing various diseases such as diabetes mellitus (DM), cardiovascular diseases and blood pressure (BP). The other disease which can be mitigated by the millet includes thyroid disease and celiac disease.⁴ Millets are gluten-free, alkaline, one of the best fortification agent (fortifier), favourable in digestion, rich in cell reinforcements, and phenolic compounds and are adequately edible. It also helps in bringing down bad cholesterol like low-density lipoprotein (LDL), and very low-density lipoprotein (VLDL).⁵ That is the reason they are denoted as Nutri-cereals and sometimes called as superfoods. Millets are extremely resistant to dry, arid and other extreme weather conditions.² According to the Indian Council of

Agricultural Research and the Indian Institute of Millets Research Nutri-cereals (ICAR-IIMR) millets are highly nutritious grains that have a comparable amount of nutrients to staple food. Rice, wheat as well as various other millets and cereals, are consumed as staple foods in India. India is promoting foxtail millet, barnyard millet, quinoa, and pearl millet. All of these food crops are abundantly rich in nutrients, but they are becoming obsolete due to our shift to cultivate rice and wheat.²

Studies done on the nutritional value of millets found that millets contain protein, minerals, iron, calcium, fibre, high-density lipoprotein (HDL) and cancer-preventive agents. Most importantly millets are gluten-free and they can be given to persons who have an allergy to gluten products.⁶ The largest concentration of flavonoids is found in the finger millet. Flavonoid levels are higher in red and brown-coloured millet species due to the presence of anthocyanin flavonoid-type pigments. According to the literature, foxtail millet, pearl millet, and proso millet have higher levels of phenolic acids. It has been observed that the brown form of some finger millet is the only millet that has the presence of tannins.⁷ Now we will discuss various types of millet and their important nutritional properties by which they show their effects in the prevention various diseases.

Pearl millet (*Pennisetum glaucum*) :

Pearl millet, also known as Bajra, is a popular indigenous millet that grows well in sandy soil and requires little irrigation.⁵ Pearl millet may be easily preserved at low temperatures and moisture levels due to its increased oil content (4-9%).⁸ Its flour is used in a variety of bakery and traditional culinary products and is high in both micro as well as macronutrients. It has a high amount of macronutrients such as calcium and magnesium. Micronutrients that are present in the Bajra are vitamin B complex, folate, copper, zinc, iron and unsaturated fatty acids.² It has high folate content that makes it a biofortifier for the populations who have folate deficiency anaemia. The existence of magnesium can remedy patients suffering from migraines and also support patients with asthma.⁴ It also contains phytonutrients, which will be helpful in defending against breast cancer and cardiovascular diseases.⁹ A study done on diabetic rats on a pearl millet diet, was observed to have hypoglycemic effects and improve the control of lipidemia.¹⁰

Sorghum (*Sorghum vulgare*) :

Sorghum, also known as Jowar, is a long-established staple food in Maharashtra and India. Sorghum is the fifth most-produced crop in the world and the fourth crop production in India. It is supposed to have more nourishing value than rice and wheat because of its high β -carotene, folic acid, fibre, thiamine, and riboflavin content.² Tannins, flavonoids, and phenolic acids are also present in large concentrations in the Sorghum. Sorghum contains antioxidant properties and pigment levels are as high as vegetables and fruits. On epidemiological data, it has been observed that esophageal cancer is less who are on millet and sorghum diets which denotes the anticancer properties of sorghum.¹¹ It is also enriched in macronutrients such as calcium, potassium, phosphorus and sodium. B complex vitamins are also observed.

Micronutrient such as iron, and zinc is present in the sorghum in abundant amount. It also aids in the treatment of arthritis, heart-related cardiovascular diseases, lower body weight and body mass index (BMI), malnutrition, and obesity.¹²

Finger Millet (*Eleusine coracana*) :

Finger millet is a yearly, dry-season crop that requires fairly consistent precipitation. It is commonly known in India as Ragi. Ragi contains a large amount of protein. Dietary fibre, and essential amino acids are other constituents of the finger millets. Vitamins are also present such as vitamin A, and vitamin B complex.⁵ The presence of calcium is 10 times that of wheat in millet. Prevention of high blood cholesterol can be achieved. Being high on dietary fibre can prevent constipation.⁶ It is regarded as the greatest diet for diabetics since it regulates and normalizes blood sugar levels.⁵ A study done by Banerjee et al.¹³ found that flavonoids and phenolic compounds had an activity against pathogenic bacteria and viruses. They found that bacteria such as *Klebsiella*, *Bacillus*, *Escherichia*, *Listeria*, *Proteus*, *Pseudomonas*, *Serratia*, *Staphylococcus*, *Yersinia* and *Streptococcus* are inhibited by the flavonoids present in the millets. Beverages can be made with the extract of finger millet and one such study suggests that a beverage that can be given instantaneously of a finger millet extract can be used in the management of calcium-deficient disorders.¹⁴ Finger millet seed shells have anti-teratogenic and anti-fertility effects on diabetes, hypocholesterolemia, and hypoglycemia and have a renoprotective nature.¹⁵

Foxtail millet (*Setaria italica*) :

Foxtail millet is indigenously also known as Kangni in India. It is the second most produced millet in India. These millets require less amount of water and irrigation facilities. In India where Irrigation facilities are not well developed these crops can be grown adequately. Foxtail millets can be resistant to pests and these are very high in protein, dietary fibre, calcium, vitamins, iron, and copper. Foxtail millet is one variety that is also resistant to plant diseases.⁵ It is non-acidifying and non-glutinous, making it easily digestible. The glycemic index of the foxtail millet is low so the rise of Insulin is steady state and a very low peak is observed.¹⁶ The other chemicals which are present in the foxtail millet are catechin, quercetin, apigenin, and kaempferol, which aid in the treatment of diabetes mellitus and dyslipidemia which can ultimately decrease cardiovascular disease. Because of the presence of magnesium, it protects the heart from disease which is also called as “healthy heart food”.^{9,17} A study done by Thakur and Tiwari⁹ also demonstrated antimicrobial, anti-tumorigenic properties and it also aids in body detoxification. Foxtail millet has improved heart health in hyperlipidemic mice by reducing triglyceride levels in plasma. Foxtail millet has anti-cancer effects. Furthermore, a previous study concluded that foxtail millet-derived phenolic extract strongly hinders MDA-MB-dose-dependent proliferation of 231 breast cancer cells.¹⁸

Quinoa (*Chenopodium quinoa*) :

Quinoa can grow at a very high altitude approximately 3500-4000 meters above sea

level in cold as well as high climatic zones and can be used in cooking food, baking, or as a crop for animals.¹⁹ Quinoa possesses an immense amount of protein, quinoa is classified as a pseudo-cereal.²⁰ Like other millets, quinoa has other chemical such as flavonoids, polyphenols, and phytosterols. It is high in protein, dietary fibre, minerals, and vitamins, which aid in the treatment of diabetes, protein-energy deficiency, celiac disease, dyslipidemia maintenance, and cardiovascular disease. It also has a high amount of amino acids such as lysine and methionine, which are deficient in grains.²¹ Because of its greater mineral and protein, micro and macronutrients it is gaining popularity as a superfood in developed countries such as North American and European countries.²²

Barnyard millet (*Echinochloa frumentacea*) :

Barnyard millet is a fast-growing millet crop. The harvest time for this is only 6 weeks. It is high in protein and dietary fibre, and low in carbohydrates. Three types of fatty acids are found in barnyard millet, namely linoleic acid, palmitic acid, and oleic acid. Barnyard millet is particularly good in lowering blood sugar levels and because it is gluten-free, it also protects against celiac disease.⁵ Like all other millets, they also consist of anti-oxidative phenolic chemicals and flavonoids. Derivatives of serotonin can also exist in the barnyard millet.²³ Barnyard millet has ample amounts of antioxidants and helps maintain normal glycemic profile and normal lipid levels.²⁴

Little millet (*Panicum sumatrense*) :

Gajrao is the popular name for the little millet. It has almost 37-38% dietary fibre and a significant amount of protein.⁵ Little millets also include apigenin, which aids in the treatment of diabetes mellitus, enteric diseases like celiac disease, and cardiovascular diseases such as stroke and myocardial infarction, and acts as an anti-cancer agent.⁹ These are also beneficial to wheat-intolerant individuals. Little millets contain a lot of vitamin B and are high in phosphorus and iron. Little millets that germinate are rich sources of α -amylase.²⁵

Kodo Millet (*Paspalum scrobiculatum*) :

Kodo millet is drought-resistant, pest-resistant, and native to the African continent. Kodo millet was not indigenous in India but became indigenous Indian millet some 3000 years ago due to cultivation.²⁶ Kodra is another name for Kodo millet. Kodo millet has the paramount dietary fibre content is good for maintaining euglycemia and is good for diabetic people. It has a high protein content. Kodo millet has a very low-fat content and can be used in metabolic syndrome and patients of dyslipidemia and hypercholesterolemia. Like other millets, it is gluten-free and contains all micro and macronutrients. Lecithin one of the ingredients of kodo millet is beneficial to the nervous system.⁵ In preclinical studies it has been demonstrated that Kodo millet can predominantly reduce hyperglycemia caused by alloxan in rats. Patients with beriberi can be treated with Kodo millet and roots of the Kodo plant have the property of diuretics.²⁷

Proso Millet (*Panicum miliaceum*) :

Proso millet is a very old-fashioned crop that is a constitutive part of the human diet, particularly in continents such as Asia, Australia, and Europe.²⁸ Chena is the dialectal name for proso millet, which has a shorter growth season for the cultivation of the Proso millet.²⁶ Like other millets, it is also enriched in macronutrients such as calcium. Dietary fibre, and protein are also present in the Proso millet and it is gluten-free. Set against other available cereals and other foods, it is the most affordable source of manganese. It aids in the improvement of lipid profiles and the aids in declining the level of cholesterol. Proso millets are beneficial to bone health (Rao et al. 2018). Proso millet carotenoid extract has exceptionally strong cellular antioxidant activity consistent with fruits and vegetables.²⁹ Choi et al.³⁰ found that the Proso millet decreased the insulin level by boosting the glycemic response in mice. Another study on diabetic rats proved the preventative nature of Proso millet protein concentrate and stated that it immediately improves D-glucosamine-induced liver damage in rats.³¹

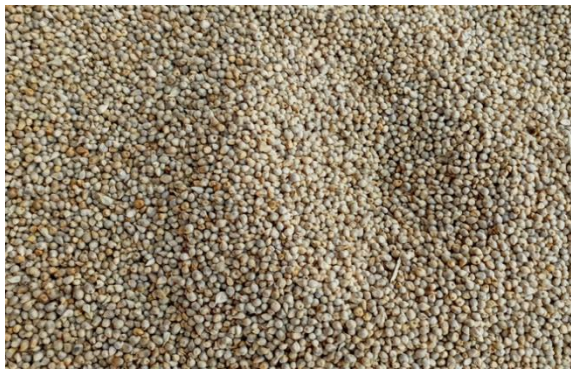


Fig. 1 Pearl Millet (Bajra)



Fig 2. Sorghum (Jowar)

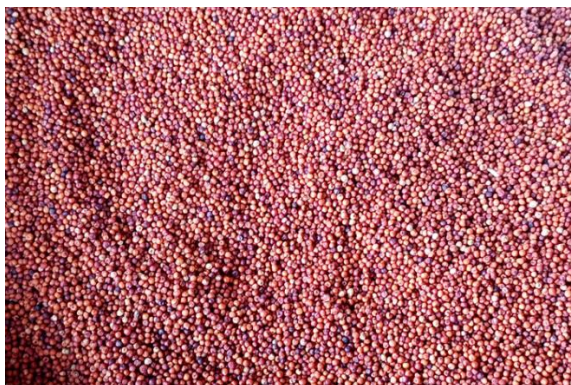


FIG. 3 Finger Millet (Ragi)



Fig. 4 Foxtail Millet (Kangni)

A millet seed protein consists of albumin fractions, globulin, cross-linked prolamin (b-prolamin) and glutelin. However, the relative amounts of these proteins vary according to the millet seed selection. In addition, an analysis of the amino acids of the millet proteins revealed large numbers of essential amino acids including sulfate-containing amino acids (e.g. cysteine and methionine).³² The plant peptides are usually smaller protein fragments (e.g., 10 kDa) than

the millet proteins. These peptides can be found in nature or derived from native/precursor proteins through gastrointestinal hydrolysis (proteolytic enzymes). Bioactive peptides (BAP) are by-products of different biological sources that have positive effects on overall human health. Bioactive millet peptides (BAMP) have been found to have distinct biochemical effects on human health in the following ways: It shows anti-microbial action, antioxidants as it fights against free radicals, antihypertensive agents decreasing blood pressure by stimulating ACE inhibitors anti-cancer drugs and anti-diabetic effect.^{33,34,35,36,37} now we will discuss the various properties of the millets and how they have an effect on the diseases.

Antimicrobial activity :

The recent emergence of drug-resistant bacteria and viruses species needs exploratory study of naturally present antibacterial and antiviral agents. Antibacterial/viral agents containing proteins need to be generated with a potential for clinical use. The study by Camargo et al.³⁸ is progressing in this direction which demonstrated the presence of antiviral peptide in Jowar. A 2 kDa peptide derived from Jowar showed strong inhibition against Bovine herpesvirus (BHV), replication of herpes simplex (HSV-1) and weak activity against poliovirus. Furthermore, the peptide has also been shown to inhibit the spread of HSV-1 infection and simultaneous preventive effect against secondary infection in vitro.³⁸ Rich in glycine and cysteine Sequences present in these peptides were responsible for Antifungal activity.³⁹

Such an order Similarities have also been observed in many other plant proteins hydrolyzate containing antifungal/antibacterial active ingredients.^{40,41,42} Fujimura et al.⁴¹ showed two new antibacterial agents identified Buckwheat-derived peptides Fa-AMP1 and Fa-AMP2 showed a wide range of antibacterial activity against Gram-positive (*Clavibacter michiganensis* and *Curtobacterium faccumfaciens*), Gram-negative bacteria (*Agrobacterium rhizogenes*, *Agrobacterium radiobacter*) and plants. Pathogenic fungi (*Fusarium oxysporum*, *Geotrichum candida*. Xu et al.⁴³ the authors demonstrated various activities of millet-derived peptides fungal species, including *Fusarium oxysporum*; *Trichoderma viride*, *Botrytis cinerea*, and *Alternaria* appear alternately. In addition, proteins and peptides obtained from finger millet, Barnyard and proso millet exhibited a diverse spectrum Antibacterial effect against *Pseudomonas aeruginosa* (MTCC 424) and *Salmonella enterica* (MTCC 739).⁴⁴ There are also 3 foxtail millets derived peptides FFMP4, FFMP6 and FFMP10. showed strong antibacterial activity against *E. coli* ATCC 8099.⁴⁵

Anti-Cancerous Effect Of Millet :

Since uncontrolled cell proliferation is a key characteristic of the development and progression for the development of cancer, most anticancer drugs are designed to target high-proliferation and regenerative cells.⁴⁶ However, several bioactive peptides derived from various sources have shown anticancer activity.^{47,48,49} Buckwheat-derived 4kDa peptide has also been shown to inhibit the growth of Hep G2 (Hepatoma), breast cancer MCF-7 and liver embryonic

WRL 68 with an IC (50) values of 33 μM , 25 μM , and 37 μM . However, buckwheat peptides did not induce mitogenic responses on splenocytes and did not induce macrophage nitric oxide production.⁵⁰ One of the etiological factors for the development of cancer is the formation of reactive oxygen species. Quinoa-derived peptides such as LWREGM (F-1), DKDYPK (F-2), RELGEWGI (F-3), DVYSPEAG, IFQEYI possess antioxidant property has been proposed as a potential anticancer drug for the prevention of the reactive oxygen species and development of cancer.⁵¹ Lignin helps prevent colorectal, breast and prostate diseases, and many other types of cancer. Sitosterol in diet (SIT) in millet may protect against colon cancer-induced colon cancer chemically. SIT helps significantly reduce tumors in mice.⁵² Lignin has anti-cancer and anti-cancer effects that induces the growth of bifidobacteria by short formation propionate, acetate and butyrate acid series. butyrate has a secondary chemopreventive effect by reducing growth cells from cancerous lesions and inhibiting malignant tumorstraining.⁵³

Antihypertensive effects of the millets :

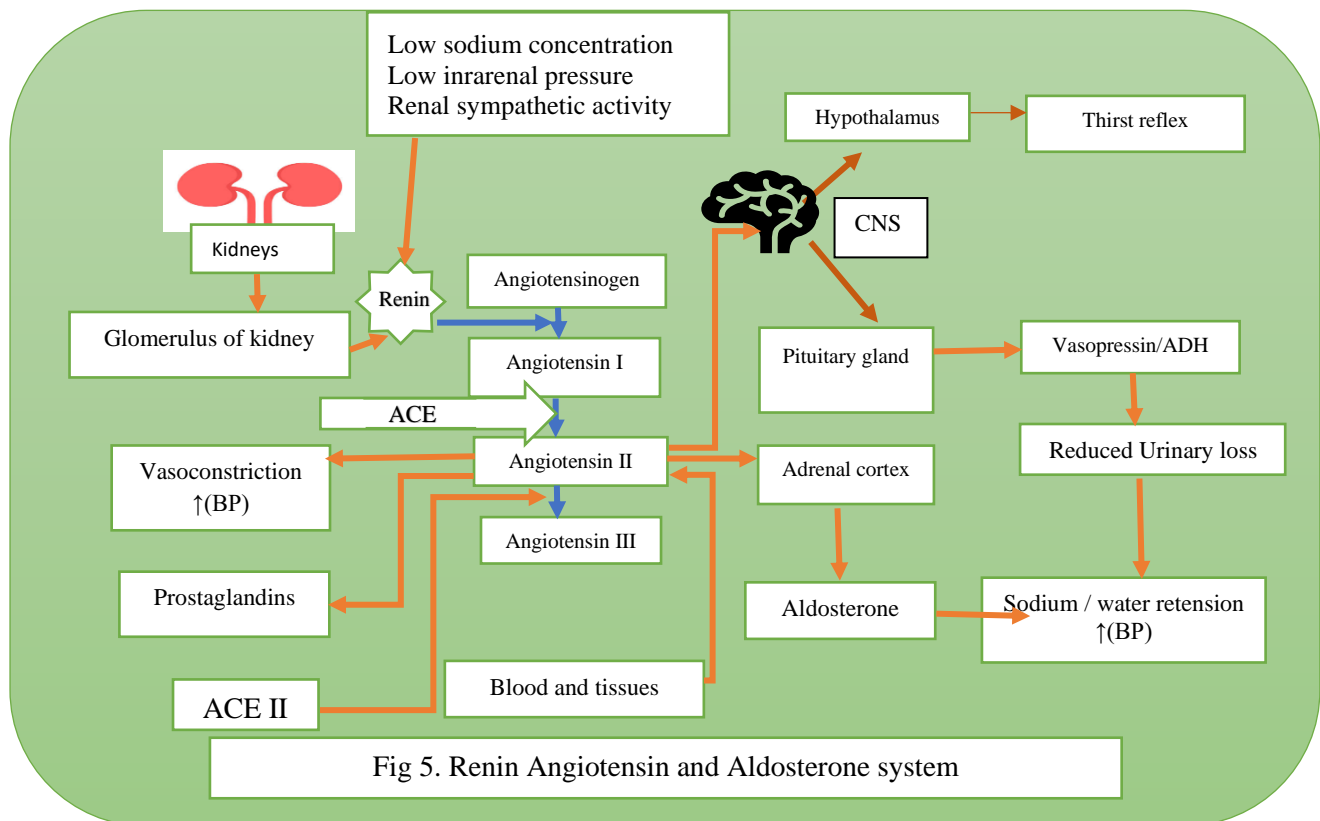
The human body has many complex systems to maintain the milieu inside the body for proper functioning. One such system is the Renin Angiotensin and Aldosterone System (RAAS) which maintains the normal functioning of the Blood pressure in the long term.⁵⁴ This system affects the functioning of the kidney and heart through various Hormones such as Renin, Angiotensin, Aldosterone and also to some extent the pituitary hormone.⁵⁵ When the glomerulus senses the low amount of volume or low sodium content the juxtaglomerular cell of the kidney secretes the Renin hormone.⁵⁶

This renin acts on the angiotensinogen which is converted to angiotensin I and this Angiotensin I now converts to angiotensin II and subsequently to angiotensin III.⁵⁷ Angiotensin II by contracting the blood vessel it increases the blood pressure.⁵⁸ Also Angiotensin II acts on the adrenal cortex to signal the aldosterone. Now the Aldosterone by acting on the kidney absorbs the Na^+ and water and increases the blood volume thereby increasing the Blood pressure (BP).⁵⁹ Also renin acts directly via the beta receptors of the heart thereby increasing the contractility of the heart and causing an increase in the BP.⁶⁰ This is depicted in the fig. 5

By targeting the ACE enzyme we can contribute to the regulation of the BP.⁶¹ Also directly inhibiting renin can also contribute to the well maintenance of the BP.⁶² Several bioactive peptides which are extracted from the millets have shown antihypertensive activity in various studies.^{63,64,65,66,67}

A study by Koyama⁶⁸ in vivo, looked at the blood pressure-lowering effects of bioactive peptides derived from lactic fermented buckwheat sprouts. They identified six new bioactive peptides: FQ, VAE, VVG, DVWY, WTFR, and FDART. A single dose of these peptides was administered to hypertensive rats, resulting in a significant reduction in blood pressure. Protein hydrolysates from quinoa inhibit the activity of ACE enzymes.⁶⁹ In another study, Chia bioactive peptides obtained by regulated protein hydrolysis through the Alcalase and Flavourzyme sequential system demonstrated extensive inhibition of ACE in vitro. These results suggest that inhibition of ACE by Millet peptides could be effective on RAAS as well

as the kallikrein-kinin system and may be useful in the treatment of hypertension ultimately useful in the prevention of Cardiovascular and chronic diseases of heart and kidney.⁷⁰



Antidiabetic effects of millet :

Diabetes is one of the common diseases due to the destruction of the β islet Langerhans cells and insulin insensitivity leading to hyperglycemia.⁷¹ Diabetes mellitus can be classified into two types, namely Type I and type II diabetes mellitus. In type I DM, destruction of the β islet Langerhans cells occurs due to the autoimmune antibody produced against the β islet Langerhans cells.⁷² Type II DM is due to insulin insensitivity or due to the decreased amount of the insulin.⁷³ An experiment that used diabetic mice to test different diets, came to the conclusion that added millet protein can increase insulin sensitivity and lowers blood sugar and triglyceride levels.⁷⁴ In their 3 weeks study, they also found additional benefits such as an increase in plasma levels of adiponectin, as well as an increase in HDL cholesterol.⁷⁵ In a study in India, Jali et al.⁷⁶ reported that patients who received T2D for 90 days were able to improve glycemic control and other aspects of their health. In one study, the patients were given a diet of foxtail millet with a mixture of split black gram and spice mixed with strict compliance. The result of the study was phenomenal, it showed a decrease in HbA1c level, and fasting glucose, increased insulin sensitivity, decreased total cholesterol and triglycerides and LDL concentrations. The study inferred that the diet has a positive impact on patients of Type II DM ultimately leading to better cardiovascular health.^{77,78,79} Two another study which was done with proso millet and foxtail millet concluded that improved HDL cholesterol and reduction in plasma glucose concentration have been achieved. The results showed Total

cholesterol All of these results indicated that this diet had a positive impact on patients with T2DM.^{80,81} It has also been found that hydroxyproline or N-acylated and derivatives of hydroxyproline found in millet can also be used as an anti-diabetic agent.⁸²

Effect Of Millets On Cardiovascular Disease :

The risk factors for cardiovascular diseases are increased blood pressure, diabetes mellitus, metabolic syndrome, obesity, dyslipidemia, sedentary lifestyle etc. Millets can decrease blood pressure as discussed already owing to their inhibitory effect on the RAAS system. After a meal, there is less amount of insulin spike occurring with the millets so thereby millets can prevent cardiovascular diseases.⁸³ Generation of free radicals can lead to the development of cardiovascular diseases. The main presence of dietary fibre, b-glucans, policosanols, and phytosterols have anticholesterolemic properties while the presence of apigenin, and flavonoids has antioxidant properties. Millets being an antioxidant property can help with the management of cardiovascular disease.⁸⁴ Chronic myeloid leukaemia (CML) is the uncontrolled growth of clear marrow cells in the bone marrow. Finger millet like Nutri-cereal helps cure diseases many infectious diseases. Millet seed extract has anti-proliferative activity on CML k562 due to the presence existence of a bifunctional trypsin alpha-amylase complex inhibitor, i.e. RBI (ragi binary inhibitor), helps by simultaneously inhibiting trypsin and alpha-amylase.⁸⁵

Challenges For The Millets :

Once was a staple diet in India now there are various types of challenges with the millets being a staple diet. The most important challenge for the millets a lack of awareness. Many people don't know what are millets. Bajra is a millet but many people don't even recognize it falls under the category of millet. A similar thing happens with the jowar. Even many dieticians don't know the products which fall under the category of millet. Lack of awareness in cooking millets is one of the drawbacks in the consumption of this superfood.⁸⁶ The other limitation is a lack of familiarity. If given the choice the customer is still hesitant to pick the millet instead of wheat and rice.⁸⁷ After the 1960s green revolution India became self-sufficient and got its food security and the Indian staple diet shifted from millet to rice and wheat.⁸⁸ This shift had happened because of the sudden shift in the availability and affordability of rice and wheat.⁸⁹

Another hindrance identified was a lack of convenience in cooking. Millets need to be cleaned, grounded and pounded before they can be cooked. Millets also need more time for cooking as compared to rice and wheat that is because they requires pre-soaking overnight before consumption. In this era of the modern world where time is money people need to buy food which is clean, grounded and ready to cook.⁹⁰ Affordability is also one barrier to the consumption of the millet. People are now understanding the importance of the superfood millet, but bakery products such as cookies, and biscuits are costly than their counterparts such as wheat and rice. People who are health conscious can't purchase this because of the high cost. Farmers were not cultivating the millet because they were mostly cultivating the rice and wheat crops and sugarcane as cash crops instead of millets.⁹¹

Taste is one of the attributes that millets are not so common. Millets are slightly bitter and it is more coarser in texture. As wheat and rice are sweet and smoother in texture we prefer that food over the most healthy food. Millets has been considered as an inferior food by many Indians and it is one of the barrier for the millets.⁹² In India it is thought that rice is associated with the Brahminical rites and millets are considered as a poor man's food.⁹³ Building a brand is utmost for that product needs sustenance. So, the lack of a brand in the millet industry is one of the challenges for the millet to be considered a superfood and requires extensive efforts to reach to every individual.^{94,95}

Conclusion :

Millets are abundant in protein and can be given to patients of protein and energy malnutrition. Millet seeds contain minerals, and multivitamins, and act as antioxidants, helping to detoxify the human body. High calcium concentration minerals help fight bone problems and control weight. It has been revealed that consumption of Barnyard millet is considered a food to achieve high satiety value and no to less desire to eat between millet meals decreasing the amount of binge eating and exhibiting comfortable bowel movements that cure illnesses such as constipation. Millet improves the diastolic and systolic blood pressure profiles of people following a millet-based diet. The millet diet, strikingly finger millet, foxtail millet and Sorghum are recommended for patients with diabetic mellitus. Foxtail and barnyard millet have the propensity to repair the cells and tissues of the body. Owing to their antioxidant property millet can detoxify the immune system and can prevent cardiovascular disease. Millet also has anticancer properties and the effect of that can be seen in premenopausal women for example breast cancer may be prevented in pre-menopausal patients. Polyphenols also inhibit cataract formation in humans by inhibiting its main cause, aldolase reductase. Millets are the best bio-enhancing agents and their high iron content helps in preventing anemia. As a function-traditional millet dish is economical and rich in calcium helps fight the risk of calcium malnutrition in children, pregnant women and breastfeeding women.

There are some challenges present in the consumption of millet viz affordability challenge, costing, inferiority challenge, and lack of convenience in cooking. The food with millet is less tasty and coarser than that of their counterparts such as wheat and rice which are sweeter and smoother. Instead of investing in their health from the start and buying a millet-based diet which are only 10% higher than that of the rice or wheat-based diet, people are prepared to pay to large amount of hospital bill through insurance. One another reason for the millet unpopularity is, after the green revolution wheat and rice were more affordable and readily available than that of millet. Despite these challenges, people are now understanding the health benefits of millet and consumer are restarting to consume the millet-based diet. Nowadays lifestyle diseases are rampant. The prevalence of cardiovascular disease, hypertension, stroke, cancer, and diabetes is increasing day by day due to our lifestyle and diet. Millets can be one aspect of fighting these non-communicable diseases. The polyphenols that are present in the millets can have the preventive properties as the anticancer agents. Being an antioxidant it can also have a cardioprotective effect. Millets have gained popularity over the

past few years due to their health benefits such as preventing heart diseases, maintaining a normal insulin level, a high amount of calcium leads to good bone health, and a high amount of protein can be used in the treatment of protein malnutrition. They can also decrease hypertension and normalize blood pressure owing to their inhibitory effect on the RAAS. So in conclusion, with so many health benefits and once a forgotten food, millet can be considered as a superfood.

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