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MEDICINAL VALUE OF MILLETS FOR HEALTHY LIFE

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ABSTRACT: Millets are one of the oldest foods known to humans and possibly the first cereal grain to be used for domestic purposes. The Indian flatbread roti is made from ground millet seeds. In malice of all these extraordinary rates and capacities of millet husbandry systems, the area under millet products has been shrinking over the last five decades and swiftly after the green revolution period. The bitsy "grain" is gluten-free and packed with vitamins and minerals. Millet grain is largely nutritive with good quality protein, rich in minerals, salutary fiber, phytochemicals, and vitamins. The nutritional composition of the millet is compared with that of rice and wheat. Value-added products from millet have the eventuality to add value to the business and grow as consumers believe that millets and millet-predicated foods contribute directly to their health.

INTRODUCTION: Millets are one of the oldest foods known to humans & possibly the first cereal grain to be used for domestic purposes. It's a cereal crop plant belonging to the grass family Graminae. The term millet refers to several types of small-seeded periodic meadows that belong to the species under five rubrics, Panicum, Setaria, Echinocloa, Pennisetum, and Paspalum in the lineage Paniceae and one rubric Eleusine, in the lineage Chlorideae [1]. The origin of millet is different, with kinds coming from both Asia and Africa. Millets have been the main millions of the people of semi-arid tropics of Asia and Africa for centuries where other crops do not grow well [2]. This Nutritional Bulletin includes nutritive profile of Sorghum, Pearl millet, Finger millet, Foxtail millet, Common millet, little millet, Barnyard millet, and Kodo millet.

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Nearly all the millets are used for mortal consumption in most developing countries, but their use has been primarily confined to beast feed in developed countries. Sorghum and millets are gluten-free, hence, are useful salutary cereals. Millets are a rich source of fiber, minerals, and B-complex vitamins. The high fiber content and some anti-nutritional factors like phytates and tannins in millets affect the bioavailability of minerals. Many studies in humans have suggested that immersion of iron tends to be lower from millet than from rice or wheat [3]. Millets are also rich in health-promoting phytochemicals like polyphenols, lignans, phytosterols, Phyto- estrogens, and phytocyanins. These serve as antioxidants, vulnerable modulators, detoxifying agents, etc. And hence cover against age-related degenerative conditions like cardiovascular conditions (CVD), diabetes, cancer, *etc*. [4].

Definition of Millets: Millets are largely variable small-seeded meadows, generally planted as cereal crops and grains worldwide. Millet can be white, green, unheroic, or red and is bitsy in size and round in form. These are veritably high in terms of

their nutritional content. As for proteins, minerals, and vitamins, each millet is three to five times nutritionally better than rice and wheat. Millets are rich in B vitamins, calcium, iron, potassium, magnesium, and zinc, and gluten-free. They have a low GI, so millets are ideal for wheat disinclination and s dogmatism in humans. Weight loss millets are also suitable for diabetics.

Types of Millets:

1. Finger Millet (Ragi).
2. Foxtail Millet (Kakum/Kangni).
3. Sorghum Millet (Jowar).
4. Pearl Millet (Bajra).
5. Buckwheat Millet (Kuttu).
6. Amaranth Millet (Rajgira/Ramdana/Chola).
7. Little Millet (Moraiyo/Kutki/Shavan/Sama).
8. Barnyard Millet.
9. Broomcorn Millet.
10. Kodo Millet.

Application of Millets:

- Its main purpose to feeding to society; around 75% production of wheat is use for feeding to population.
- Soft wheat production is used for mostly for manufacturing to bread.
- Hard wheat flour is used for making to biscuit, cake *etc*.
- Good proportion is used to storage for the germination of planting.
- Millets straw is used as cattle feed, for thatching roof and in the cottage industry for preparing hats, mats, ropes, sound absorbing, strawboard and used as litter material.
- Millet husk is used as animal feed, paper making, and fuel source.
- Millets bran is used in cattle and poultry feed; defatted bran, which is rich in protein, can be used in the preparation of biscuits and as cattle feed.
- Millets bran oil is used in the soap industry. Refined oil can be used as a cooling medium, like cottonseed oil/corn oil. Rice bran wax, a by-product of rice bran oil, is used in industries.
- Millets is also used in the manufacturing of paper pulp and livestock bedding.
- Millets flour is rich in starch and is used for. Making various food materials.
- Brewers also use it in some instances to make alcoholic malt [5].
- Millet is grown for livestock and birdseed in the United States.
- It helps control winter annual grass weeds, manage disease and insect pressure and preserve deep soil moisture for wheat.
- Millet can also be used as a rotational crop with corn or sorghum owing to its tolerance for atrazine, the primary herbicide used in corn and sorghum production systems.
- Good proportion is used to storage for germination of planting [6].

History millet is allowed to have begun in North Africa, specifically in Ethiopia, where it has been consumed since Neolithic times. There is indeed a citation of millet in the Bible as an element for unleavened chuck. Millet is still an extremely important food chief in Africa, where finely base millet is used to make traditional flat chuck known as injera. Since, ancient times, millet has been considerably consumed in Asia and India.

The Indian flatbread roti is made from ground millet seeds. In the Middle Ages, before potatoes and sludge were introduced, millet became a staple grain in Europe, especially in Eastern European countries. The Seteria variety of millet was introduced into the United States in the 19th century. While millet has been used primarily for birdseed and beast fodder in Western Europe and North America, it's now gaining fashion capability as a succulent and nutritious grain that can be enjoyed for both its unique graces as well as the fact that it's a gluten-free grain volition to wheat. India, China, and Nigeria 7 produce the maturity of the world's marketable millet crop.

Origin: The origin of millets gives their scientific name, and common names are as follows [8].

TABLE 1: ORIGIN OF MILLETS GIVES THEIR SCIENTIFIC NAME AND COMMON NAMES

S. no.	Scientific Name	Common Name	Origin
1.	*Sorghum bicolor*	Sorghum, Great millet, Guineacorn, kafir corn, Aura, Mtama,Jowar, Cholam. Kaoliang, Milo, Milo-maize	Northeast region of Africa (Ethiopia- Sudan border)
2.	*Pennisetum glaucum*	Pearl millet, cumbu, Spikedmillet, bajra, Bulrush millet, candle millet, Dark millet	Tropical WestAfrica
3.	*Setaria italica*	Foxtail millet, Thenai, Italian millet, German millet, Hungarian millet, Siberian millet	Eastern As a(China)
4.	*Panicum sumatrense*	Little millet, Samai	Southeast Asia
5.	*Paspalum scrobiculatum*	Kodo millet, Varagu	India
6.	*Panicum miliaceum*	Proso millet, common millet,	Central and Eastern Asia
7.	*Echinochloacrusgalli*	Hog millet, broom-corn millet, Russian millet, brown corn,Panivaragu	Central and EasternAsia
8.	*Echinochloacoracana*	Barnyard millet, sawa millet, Japanese barnyard millet, Kudhiraivali	Japan
9.	*Eleusine coracana*	Finger millet, African millet,koracan, ragi, wimbi, bulo, telebun, Ragi	Uganda or neighbouring region

Millet Production: Top twenty millet-producing countries include India, Nigeria, Niger, China, Burkina Faso, Russian Federation, Mali, Sudan, Uganda, Senegal, Chad, Ethiopia, Nepal, Tanzania, USA, Pakistan, Myanmar, Ghana, Ukraine and Angola (Food and Agricultural Organization of United Nations). The world's millet product is represented by South and East Asia (about 60), Eurasia and Central Asia 14, Africa 16 and the rest of the World [10].

India is the largest patron of millet grains, producing about 33-37 of an aggregate of 28 million tonnes of the World yield. Minor millets are grown over 7 million hectares of land in India, producing 5 million tons of grains. The variousness of millet kinds in the dry lands of southern India is analogous to the diversity seen in Africa [4-5]. In recent times, millets have been honored as important backups for major cereal crops to hope up with the world foods storehouse and to meet the demands of adding the population of both developing and developed countries. Millet grains which regard for about one sixth of the total food grain product, hold an important place in the food grain frugality of India [9].

Store House of Nutrients: Millets contain about 8.0 percent protein and 4.0 percent fat. They're a rich source of vitamins and minerals. Millets are especially rich in calcium. The salutary carbohydrate content of millets is also fairly high. Protamine's and glutens form the major portion of their proteins. The fats from millet contain an advanced portion of unsaturated adipose acids and force essential adipose acids [10]. Millets contain an advanced proportion of unapproachable carbohydrates and release of sugar from millet is slow. Millet protein contains amino acids in balanced proportions and is rich in methionine, cysteine and lysine. These are especially salutary to insectivores who depend on factory food for their protein aliment. Important vitamins videlicet thiamine, riboflavin and niacin are present in high amounts. Millets, a rich source of salutary fiber give a wide range of nutrients and phytochemicals, including salutary fiber, vitamin E, magnesium and folate that optimize health [11]. So millet should be store according to their nutritive value and humidity content presence on the storehouse time. It generally prefers to storehouse for air-tight, dry, and cool dark place for the storehouse of millets.

TABLE 2: NUTRITIONAL VALUE OF MILLETS (per 100 gm) [11-12]:

Nutrient	Protein (g)	Fat (g)	Dietary Fiber (g)	Ca (Mg)	P (Mg)	Mg (Mg)	Zn (Mg)	Fe (Mg)	Folicacid (µg)
Sorghum	09.9	1.73	10.2	27.6	274	133	1.9	3.9	39.4
Pearl	10.9	5.43	11.5	27.4	289	124	2.7	6.4	36.1
Finger	07.2	1.92	11.2	364	210	146	2.5	4.6	34.7
Kodo	08.9	2.55	06.4	15.3	101	122	1.6	2.3	39.5
Proso	12.5	1.10	-	14.0	206	153	1.4	0.8	-
Foxtail	12.3	4.30	-	31.0	188	81	2.4	2.8	15.0
Little	10.1	3.89	7.7	16.1	130	91	1.8	1.2	36.2

Barnyard	06.2	2.20	-	20.0	280	82	3.0	5.0	-
Wheat	10.6	1.47	11.2	39.4	315	125	2.8	3.9	30.1
Rice	07.9	0.52	02.8	07.5	96	19	1.2	0.6	9.32

Note: The millets' nutritional composition varies somewhat with climate and soil differences. On average, but the milling process removes most of those nutrients.

Nutrient Composition: The millet grain contains about 65 carbohydrates, a high proportion of which is in the form of non- starchy polysaccharides and salutary fibre which help in stop of constipation, lowering of blood cholesterol and slow the release of glucose to the blood conduit during digestion. Lower frequence of cardiovascular conditions, duodenal ulcer and hyperglycemia (diabetes) are reported among regular millet consumers. Millet grains are also rich in important vitamins, thiamine, riboflavin, folic acid, and niacin. Millets are analogous to rice and wheat or rich in minerals and adipose acids. Millets vary largely in the composition of carbohydrates as a proportion of amylose and amylopectin content vary from 16-28 and 72-84, singly. The nutrient composition of Millet grain indicates that it's a good source of energy, protein, vitamins and minerals including trace element. The eatable element of millet kernel is the rich source of phytochemicals, analogous as salutary fiber and polyphenols (0.2-0.3) [13].

Millets contribute to antioxidant activity with phytates, polyphenols and tannins present in it having important part in aging and metabolic complications. The topmost calcium content is present is galette millet with 344 mg/ 100g among the cereals; Also rich in phytates0.48 g/ 100g, polyphenols, tannins 0.61 [14]. Sorghum has11.9 per cent of moisture and about10.4 per cent of protein and a lower fat content of1.9 per cent. The fiber and mineral content of grain sludge is principally similar, and is1.6 per cent. It's a good energy source, provides about 349 K cal and gives72.6 per cent of carbohydrates [15]. Starch is the major carbohydrate of the grain. The other carbohydrates present are simple sugars, cellulose and hemicellulose. The amylose content of starch varies from 21.28 per cent. Sorghum is also rich in salutary fiber (14.3). Calcium, phosphorous and iron content of sorghum is 25 mg, 222 mg and4.1 mg (per 100 g of eatable portion), singly [16]. In addition, black galette millet contains 8.71 mg/ g dry-weight adipose acid and 8.47 g/dry-weight protein [17]. Kodo millet and little millet were also reported to have 37 to 38 salutary fiber, which was formerly considered ‘anti-nutrient’ and is now nominated as a nutraceutical and topmost among cereals [18]. Thus, it makes millets a complete food element suitable for large-scale use as reused products, snacks, baby foods *etc*., and also plays a major function in propagating food security among underdeveloped and developing countries.

Carbohydrates: The carbohydrate content in sorghum is composed of starch, answerable sugar and fiber (pentasons, cellulose and hemicellulose). Millet carbohydrates are classified into non-structural (sugars, starch and fructosans) and structural (cellulose, hemicelluloses and pectin substances) carbohydrates. The top-structural carbohydrate (NSC) is starch. In normal sorghum it’s mainly composed of amylopectin. The most common mutants contain waxy (only amylopectin) and high amylose starch [19]. Color of sorghum beans is related to intensity of the colors in the pericarp and in the leaves of the sorghum plant [20-21].

Starch: Starch is the most abundant element, while answerable sugars are low. Starch From one-half to three-fourths of the grain weight is starch. Starches live in a largely ranged manner in which amylase and amylopectin atoms are held together by hydrogen bonds and arranged radically in spherical grains. Starch is the main source of energy employed during germination. It's composed of direct chains of glucose joined by α- 1, 4- glyosidic bonds called amylopectin. Amylopectin is a much larger, banged polymer. The colors of millet grain pericarp sometimes discolor the starch, yielding light pink color, green and pusillanimous colors. Millet endosperm in general contains about 23 to 30 of amylase. Corneous endosperm starches have more advanced gelatinization temperature and natural density than brio isolated from the fine. The gelatinization temperature range for the brio is 71 to 80°C. The thermal properties and pasting behavior. Indicates that the pastes prepared from are short and cohesive. The water list capacity of millet starch is significantly lower than that of sorghum starch. They have high swelling power at

90 °C but lower solubility than that of maize starch. Brio from malleable millet grain is notable for rapid-fire-fire cookery, high peak viscosity, and poor stability during cookery, paste clarity, high water list capacity and resistance to gel conformation and antique gradation [22-23, 19]. Thermal transitions of malleable starch still, passed at similar or slightly advanced temperatures. For sorghum waxy flour and insulated moldable bounce have advanced brio insipidity than that of normal endosperm types [24].

Soluble Sugars: The answerable sugar content of caryopses changes during development and is maximum [25]. At maturity the average answerable sugar content was 1.3 (0.8-4.2), with sucrose being 75 of the sugars [26]. Mature caryopses contain2.2 to 3.8 answerable sugars, 0.9 to 2.5 free reducing sugars and 1.3 to1.4 non reducing sugars. Glucose and fructose ranged from 0.6 to 1.8 and 0.3 to 0.7 singly. High lysine and sticky cultivars of millets contain further answerable sugars.

Carbohydrate Digestibility For nutritional purposes, starch is generally classified into swiftly digestible bounce (RDS), slowly digestible bounce (SDS) and resistant brio (RS), depending on the rate and extent of digestion. The nutritional properties of SDS are truly important for treating and preventing various conditions. Elevated plasma glucose and insulin situations after a glucose weight are associated with noninsulin-dependent diabetes. Dragged digestion and absorption of carbohydrates are favorable not only for the salutary operation of metabolic conditions analogous to diabetes and hyperlipidemia [27], but for healthy subjects due to positive effects on several physiological factors. Therefore, SDS is given important attention as a new functional material.

Dietary Fiber: The salutary fiber contents of several Indian foods have been determined. Salutary fiber elements play their salutary effects mainly by way of their swelling properties and by adding vehicle time in the small intestine. [28] All millets have some properties likes

- Water absorbing and bulking property
- Energy diluents to formulate low-calorie diets All Millets.
- Increased conveyance time of food in the gut Reduced threat of seditious bowel disorder.
- Hypocholestero- laemic activity and reducing the threat of cardiovascular conditions [29].

Fatty Acid (Lipids): Lipids are fairly minor constituents in millets. Utmost of the lipids are located in the scutella area of the origin. Thus, lipid content is significantly reduced when the origin is removed during decortication or determination. The typical adipose acid composition of sorghum lipid is similar to that of maizeoil. The lipids can be subdivided into polar, nonpolar and nonsaponifiable lipids. The most abundant by far are the nonpolar lipids, 70- 80. The composition of the nonpolar lipids was fluently dominated by triglycerides, followed by sterols, 4.1, and diglycerides, 4.0. Triglycerides serve as a reserve material for germination. The lower abundant polar lipids (i.e., glycolipids 2.5 to 6.2 and phospholipids, 17 to 25) have important biochemical functions. The non-saponifiable mixes, 3 to 5, include carotenoids, phytosterols and tocopherols.

Protein: Protein content and consumption vary due to agronomic conditions (water attainability, soil fertility, temperatures and environmental conditions during grain development) and genotype. Millet proteins are located in the endosperm (80), origin (16) and pericarp (3) [30]. Kafirins or prolamins, also glutelins comprise the major protein fragments in sorghum. These fragments are located primarily within the endosperm's protein bodies and protein matrix, singly. Protein quality of millet in terms of amino acid profile is poor when compared to other cereals. Lysine, an essential amino acid is a limiting factor in millets.

All amino acids in pieces increased as the total protein in the pieces increased. Still, relative distribution of amino acids in the protein varied as the protein content of the sample changed; consequently, protein effectiveness should differ from one bit to another. Chances of the protein's lysine, cysteine, methionine, threonine, and tryptophan dropped as protein content of the endosperm pieces increased.

In piece the percentages of valine, isoleucine, leucine, and phenylalanine in the protein were lower than those set up in the advanced- protein pieces.

Phytochemicals: Millets are a rich source of colorful phytochemicals, including tannins, phenolic acids, anthocyanins, phytosterols and pinacosanols. These phytochemicals have implicit positive impact on mortal health. All millet grain and especially sorghum pieces retain high antioxidant activity *in-vitro* relative to other cereals and fruits [31].

Condensed Tannins: Sorghum with a specific gene (B1 _B2 _) contains tannins, the major phenolic compounds in those varieties [32]. These compounds confer some resistance to moulds and deterioration of the grain [33]. Tannin levels vary among genotypes. Condensed tannins also known as proanthocyanidins or procyanidins are high molecular weight polyphenols. Processing tannin or black sorghums into food products affects phenol levels. For example, processing tannin sorghum bran to produce cookies, and breads decreased tannin content by 52% and 72%, respectively; the loss was mainly from the high-molecular-weight tannins [34].

Phenolic Acids: Millets are a rich source of colorful phytochemicals, including tannins, phenolic acids, anthocyanins, phytosterols and pinacosanols. These phytochemicals have implicit positive impact on mortal health. All millet grains and especially sorghum pieces retain high antioxidant activity *in-vitro* relative to other cereals and fruits [35]. The fact that some millet cultivars produce large quantities of tannins, usually present in outer layer of grain, makes it unique among the cereals [36].

However, not all varieties contain condensed tannin. Anthocyanins have been extensively studied in fruits and vegetables due to their antioxidant properties and potential as natural food colors. However, limited data exist on the types and levels of anthocyanins in cereals, probably because cereals have never been regarded as a commercially significant source. The most common anthocyanins in sorghum are the 3-deoxyanthocyanidin [37].

Advantages of Millets Farming: Millet farming has some following advantages over others.

- Grow fertile even on the poor soils
- No demand for synthetic fertilizers
- Pest free crops
- Best cropping system
- Challenge crops
- Government Allocation & Scheme Initiation

Grow Fertile Even on Poor Soils: Most millets grow well on low-rich soils. Millets like Pearl millet can also be grown on flaxen soils, whereas cutlet millet grows well in saline soils. Barnyard millet thrives in low-rich soils, whereas other crops, like rice, struggle to grow in similar soils. Numerous of them are also grown to reclaim soils. Poor growers in dry land India are possessors of veritably poor lands. Millets are the only crops that sustain husbandry and food security on these lands. However, it's evidence of their hardiness and extraordinary capacity to survive veritably harsh conditions. If millets could flourish in ecological zones where average downfall is lower than 500 mm using flaxen and slightly acid soils.

No Demand for Synthetic Fertilizers: They can grow well with the use of cropland coprolites and ménage produced bio-fertilizers as nutrients, so the operation of synthetic diseases is avoided. There's no demand for chemical diseases for the growth of millets. Under dryland conditions, indeed, millets grow better in the absence of chemical diseases. Recently, growers have also started using bio-fertilizers similar to vermin compost.

Pest-Free Crops: Utmost millets similar as foxtail, little millet, kodo Millett are completely pest free when grown in traditional original landraces and under ecological conditions. And hence don't need any fungicides. Indeed in storehouse conditions, millets not only not need any fumigants, but act as anti-pest agents to store delicate beats similar as green gram.

Best Cropping System: Millets grown under traditional practices aren't just crops but a stylish Farming System. Utmost millet fields are innately bio-different.

Five to fifteen crops are planted on the same space simultaneously. The Baranaja cropping systems in the Himalayas are evidence to this. The Pannendu Pantalu system of the South is a holistic husbandry system that grows millets in combination with beats and oilseeds.

Challenge Crops: Millets can grow under failure conditions and repel advanced heat administrations. Millets grow under non-irrigated conditions in low-down administrations between 200 mm and 500 mm. They're able to face the water stress and grow. Millets are a good storage of nutrients in large amounts. They include major and micro nutrients demanded by the mortal body. Hence they can help repel malnutrition.

Government Allocation & Scheme Initiation: The government has blazoned an allocation of Rs. 300 Crores in 2011- 12 under Rashtriya Krishi Vikas Yojana to create millets as Nutricereals. Scheme on Initiative for Nutrition Security through Intensive Millets Promotion has been formulated to operationalize the advertisement. The scheme aims to demonstrate the advanced product and post-harvest technologies in an intertwined manner with visible impact to beget increased product of millets in the country. Besides adding product of millets, the Scheme through processing and value addition ways is anticipated to induce consumer demand for millet-grounded food products (INSIMP, 2011-12).

Therapeutic Advantage of Millets: Diabetic Mellitus is the most common metabolic complaint affecting mortals with health complications. Change in life style, poor salutary habits and stress lead to salutary complications. Millets being rich in complex carbohydrates, low fat, up variousness of fiber and the characteristic slow release of sugar are a good option to include in diabetic diet. Therefore millets are hypocholesteremia and hypoglycemic effects on humans.

Millets help to minimize the undesirable turn oil of undigested food factors in the gut and binding with poisons, discharging them with droppings in the colon. Therefore brings down the prevalence of colon cancer, constipation and gastro-intestinal complications. It's reported that cardiovascular conditions, duodenal ulcers, and hyperglycemia infrequently do in regular millet eaters [38]. Therapeutic benefits of millet which are following.

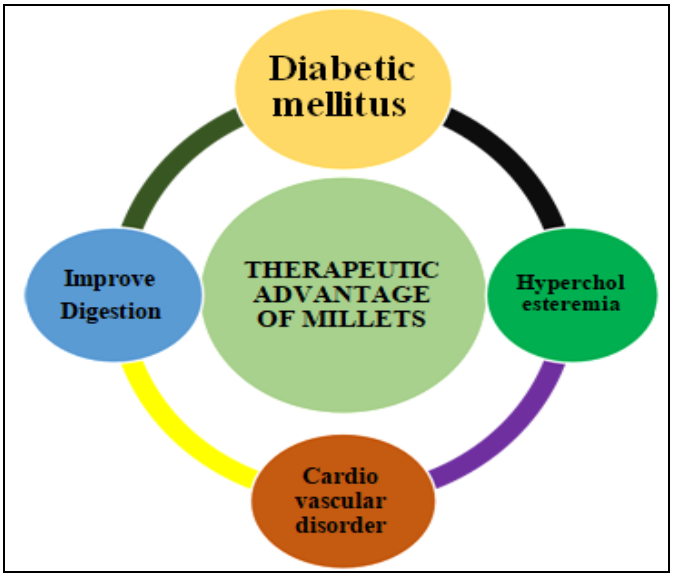

FIG. 1: THERAPEUTIC BENEFITS OF MILLET

Millets for Metabolic Syndrome: The imbalance in human metabolic patterns is called metabolic syndrome. Metabolic syndrome may increase the risk of diabetes, increase levels of cholesterol or obesity, and increase blood sugar levels. Several studies have shown the presence of arabinoxylan, tocotrienols, ferulic acids, and tocopherols in whole wheat. These bioactive compounds in wheat may reduce the risk of metabolic syndrome by keeping the blood sugar in control, lowering blood pressure and producing a healthy body mass index (BMI).

Prevents Haemorrhoids: Corn has 18.4% of the daily recommended fiber dosage, which is good for bowel movements. It can help you with various digestive problems like constipation and hemorrhoids.

Promotes Growth: Corn has high amounts of vitamin B constituents, thiamine, and niacin, which facilitate growth. Thiamine helps your body improve nerve health and cognitive functions, while niacin can prevent problems like dementia and dermatitis. Corn is also known for having high amounts of folic acid and is, therefore good for pregnant women.

Helps You Gain Weight: Corn contains all the essential minerals your body needs. It has high amounts of copper, iron, zinc, phosphorous, manganese, magnesium, and even selenium, which

is not very easy to find in other foods. Phosphorus helps with several body functions and can be used to regulate kidney function, induce normal bone growth, and maintain bone health. Magnesium can help you maintain a healthy heart rate and also boosts bone density. [39]

Millets to Enhance the Immune System: Millets are a source of a variety of nutrients and vitamins which may improve immunity. Ferulic acid and dietary fibers present in wheat may enhance the function of immune cells by producing macrophages, T-helper cells, and neutrophils.

Millets for Cancer: Millets may be used for various types of cancers. Studies have shown that consuming dietary fiber-enriched food may help to reduce the risk of colon, colorectal, stomach, liver, and pancreatic cancer. Further studies are required to check the effect of wheat on cancer in humans.

Millets for Heart Health: Millets may be used for diseases like stroke or myocardial infarction, and the high fibre intake may reduce the risk of cardiovascular diseases. A study was conducted with approximately 22000 individuals, which showed that people with a high fiber intake had a reduced risk of myocardial infarction.

Millets for Gall Stones: Millets has high indigestible fibers that may help to avoid Gall stones. Researchers have reported that individuals consuming more fibers have a lower risk of developing Gall stones than those who consume less.

Fibers speed up the movement of food inside the intestine and reduce the formation of bile acids which may be responsible for the formation of Gall stones.

Millets for Tooth Disorders: Millets may reduce the chances of toothache or tooth decay. Chewing is a must while taking wheat; this may help in the fast movement of teeth and may give proper exercise to the teeth.

Millets for Constipation: Millets may be used to produce bowel movements and thereby relieve constipation. A high amount of fibers in wheat may be useful for easy movement of stools and may prevent haemorrhoids [40].

Beneficial Effect on the Digestive System: PM can be used as a prebiotic. Non-digestible carbohydrates in PM help grow desirable microflora in the intestine. It can prevent constipation [41].

Millets for Diabetes: Millets may have anti-diabetic properties due to the presence of fiber. Studies on rats showed that high fiber intake might lower the blood glucose level. Large-scale studies on humans have shown that intake of dietary fibers may reduce the risk of diabetes [42].

Millets in Malnutrition: Kodo millets are highly nutritious due to the presence of carbohydrates, proteins, and dietary fibres, vitamins like niacin, riboflavin and minerals like calcium, iron and phosphors. Kodo millets are also rich in antioxidants and phenolic compounds like vanillic acid, gallic acid, tannins, ferulic acid *etc* [43].

Millets for Bacterial Infections: Consumption of kodo millets may have the potential to manage bacterial infections. kodo millets could inhibit the growth of bacteria like *S. aureus*, *Bacillus cereus*, *Leuconostoc mesenteroides* and *Enterococcus faecalis* which cause urinary tract infections, diarrhoea, *etc*. Thus, kodo millets may help manage bacterial infections [44].

Millets on Lipid Profile: Hyperlipidemia is the elevation in lipid components like triglycerides, total cholesterol and reduced levels of high-density lipoprotein. Conducted a study in 2013 to assess the effects of kodo millets on hyperlipidemia in rats.

Millets for Obesity: Obesity is an rising problem in India and it's appreciatively associated with several habitual conditions, including diabetes and CVD. Empirical witnesses suggest that input of high salutary fiber decreases the incidence of obesity. Which determine the posterior physiological behavior. It aids to hunger satisfaction, increasing malnutrition and reducing the threat of the development of obesity [45].

Note: More studies are required to check the effect of wheat on these problems in humans.

Adverse Effect: It may cause

- Nausea and
- Vomiting
- Indigestion
- Diarrhea
- Sneezing
- Stuffy or runny nose
- Headaches

It may cause some serious problems:

- Corn has extremely high amounts of fatty acids and therefore should be consumed with caution. People who are generally at risk of heart diseases should not eat food cooked in corn oil as it can accelerate their problems.

- Corn syrup is considered worse than sugar and is identified as a leading cause of obesity in many nations. It can also negatively impact the levels of sugar in your blood and put you at risk for type 2 diabetes. Corn syrup should ideally be avoided at any cost.

- If you have sensitive skin or are prone to allergies, consult with a doctor before adding corn to your meals. On a general note, it is always better to speak to a physician before adding anything new to your diet or lifestyle.

- Kodo millets contain goitrogens, which interfere with thyroid hormones and can result in an enlarged thyroid gland.

Millets as Convenience Foods: Cereal-grounded food products are supplemented with millets and have become decreasingly popular due to nutritional and profitable advantages. Value-added products from millet have the eventuality to add value to the business and grow as consumers believe that millets and millet-grounded foods contribute directly to their health. The millet grains offer numerous openings for developing diversified food products like bakery and puffed products, quick cuisine cereals, ready-to-eat snacks, supplementary foods, weaning foods, and, more importantly, health foods by espousing applicable milling and processing ways [46]. Convenient foods based on traditional processing have entered the market with huge success.

Breakfast Foods: Multigrain dosa mix Millet paniyaram mix, millet pongal mix, millet paniyaram mix, millet adai mix and millet puttu mix

Lunch: Multigrain Sambar rice mix, Multigrain Tomato rice mix, Multigrain Bisibele bath mix, Multigrain Biriyani, Pulav, Jeera mix

Health Foods: Nutrimalt, Thenai laddu (Nutriball)

Nutritious Blends: Nutri beverages, Malted products

Snacks: Millet Khakhra, Millet murukku, Millet bar, Millet laddu, millet blended chocolate. All over the country, request-driven accessible foods are entered in retail requests. Accessible foods similar to instant breakfast foods, formerly considered rich man food has now become an essential food item of the maturity of the population, especially among working women. The fashionability of convenience food is due to increased shelf life, unique taste, and vacuity at a reasonable cost. With this prevailing script, the tune of depleting millet grounded accessible foods has good eventuality to reach the homes in a new brand [47].

CONCLUSION: Millets are largely nutritional, non-glutinous, and non-acid-forming foods. Hence they're soothing and easy to digest. They're considered to be the least allergenic and utmost digestible grains available. Due to urbanization, increased health mindfulness and buying capacity among megacity residents, the demand for reused and convenience foods has increased drastically. Millets are much cheaper but must be duly reused for further operation. About 50 million Indians have diabetes, 15 of the Indian population is fat, and India ranks 128th among all the malnutrition countries. Hence, there's a need to educate people about millets' health and nutritional benefits to increase the consumption of millets and millet grounded products to save people from health and malnutrition-related issues.

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REFERENCES:

1. Karuppasamy P: Overview on Millets; mini review; Trends in Biosciences Print: ISSN 2015; 8(13): 0974-8, 3269-3273,

2. Chandrasekara A and Shahidi F: Content of insoluble bound phenolics in millets and their contribution to antioxidant capacity. J Agric Food Chem 2010; 58: 6706–6714.
3. Amadou I, Gbadamosi OS and Guo-Wei L: Millet-based traditional processed foods and beverages- A review. Cereal Food World 2011; 56(3): 115–121.
4. Bhatt A and Singh V, Shrotria PK and Baskheti DC: Coarse Grains of Uttaranchal: Ensuring sustainable Food and Nutritional Security. Indian Farmer Dige 2003; 34- 38.
5. Bunkar: Nutritional, Functional Role of Kodo Millet and its Processing: A Review, International Journal of Current Microbiology and Applied Sciences ISSN: 2319-7706 Volume 10 Number 01 (2021). Available at: https://doi.org/10.20546/ijcmas.2021.1001.229
6. Wang and Han: "Effect of Different Processing Methods on the Millet Polyphenols and Their Anti-diabetic Potential." Frontiers in nutrition 2022; 9: 780499. doi:10.3389/fnut.2022.780499.Availableat: https://www.researchgate.net/publication/358534642_Effect_of_Different_Processing_Methods_on_the_Millet_Polyphenols_and_Their_Anti-diabetic_Potential.
7. Radhika G, Sathya RM, Ganesan A, Saroja R, Vijayalakshmi P and Sudha A: Dietary profile of urban adult population in south India in the context of chronic disease epidemiology (CURES-68). Journal of Public Health Nutrition 2011; 14(4): 591–598.
8. Karuppasamy P: Overview on Millets; mini review; Trends in Biosciences 2015; 8(13): 0974-8, 3269-3273.
9. Gopalan C, Ramasastri BV and Balasubramanian SC: Nutritive value of Indian Foods. National Institute of Nutrition (NIN). Indian Council of Medical Research Hyderabad 2004; 59-67.
10. Phanikumar: Value added products from maize and millets. Science Tech Entrepreneur. Sources of Technology: CFTRI 2010.
11. Seetharam A, Kadalli GG and Halaswamy BH: Results of front line demonstrations and technology for increasing production of finger millet and small millets in India. In: All India Coordinated Small Millets Improvement Project. ICAR, UAS, s GKVK, Bangalore 2001; 2- 7.
12. Shree B, Rao SG and Puttaraj S: Formulation and preparation of bajra papad. Ind J Nutr Diete 2008; 45: 221.
13. Hadimani NA and Malleshi NG: Studies on milling, physicochemical properties, nutrient composition and dietary fiber content of millets. Journal of Food Science and Technology 1993; 30: 17-20.
14. Thompson LU: Potential health benefits and problems associated with anti-nutrients in foods. Food Research International Journal 1993; 26: 131-14.
15. Gopalan C, Ramasastri BV and Balasubramanian SC: Nutritive Value of Indian Foods. National Institute of Nutrition, Indian Council of Medical Research, Hyderabad, India 1996.
16. Hosmani MM and Chittapur BM: Sorghum Production Technology, published by Sarasijakshi M.H., Dharwad, India and 5910, Wood Ridge Hill, San Antanio, Texas USA 1997; 78249.
17. Glew RS, Chuang LT, Roberts JL and Glew RH: Amino acid, fatty acid and mineral content of black finger millet (*Eleusine coracana*) cultivated on the Jos plateau of Nigeria Food 2008; 2(2): 115-118.
18. Hegde PS and Chandra TS: ESR spectroscopic study reveals higher free radical quenching potential in kodo millet (*Paspalum scrobiculatum*) compared to other millets. Food Chemistry 2005; 92: 177-182.
19. Boyer CD & Liu KC: Starch and water-soluble polysaccharides from sugary endosperm of sorghum. Phytochemistry 1983; 22: 2513- 2515.
20. Freeman JE and Watson SA: Influence of sorghum endosperm pigments on starch quality. Cereal Sci Today 1971; 16: 378.
21. Subramanian V, Hoseney RC and Bramel Cox P: Factors affecting the color and appearance of sorghum starch. Cereal Chem 1994; 71: 275–278.
22. Awika JM & Rooney LW: Sorghum phytochemicals and their potential impact on human health. Phytochemistry 2004; 65: 1199-1221.
23. Awika JM, Rooney LW, Wu X and Prior RL: *Cisneros-zevallos*, L. Screening methods to measure antioxidant activity of sorghum (*Sorghum bicolor*) and sorghum products. Journal of agricultural and Food Chemistry 2003; 46: 5083-5088.
24. Klopfenstein CF and Hoseney RC: Nutritional properties of sorghum and the millets. In: Dendy, D.A.V., (Ed.), Sorghum and Millets: Chemistry and Technology, American Association of Cereal Chemists, St Paul, MN, 1995; 125–168.
25. Murty DS and Kumar KA: Traditional uses of sorghum and millets. In: Dendy, D.A.V., (Ed.), Sorghum and Millets: Chemistry and Technology, American Association of Cereal Chemists, St Paul, MN 1995; 185–221.
26. Jambunathan R and Subramanian V: Grain quality and utilization of sorghum and pearl millet. In Biotechnology in tropical crop improvement. Proceedings of the International Biotechnology Workshop. Patancheru, ICRISAT 1988; 133-139.
27. Asp NG: Nutritional Classification and analysis of food carbohydrates. American Journal of Clinical Nutrition 1994; 59(1): 679-681.
28. Narasinga Rao BS: Bioactive phytochemicals in Indian foods and their potential in health promotion and disease prevention. Asia Pacific J Clin Nutr 2003; 12(1): 9-22.
29. Narinsinga Rao BS: Dietary fibre in Indian diets and its nutritional significance. Bull. Nutr. Foundation of India. 1988; 9: 1-5.
30. Taylor JRN and Schussler L: The protein composition of the different anatomical parts of sorghum grain. J Cereal Sci 1986; 4: 361- 369.
31. Awika JM & Rooney LW: Sorghum phytochemicals and their potential impact on human health. Phytochemistry 2004; 65: 1199-1221.
32. Hahn DH, Rooney LW & Earp CF: Tannins and phenols of sorghum. Cereal Foods World 1984; 29: 776–779.
33. Waniska RD and Poe JH: Bandyopadhyay, Effects of growth conditions on grain molding and phenols in sorghum caryopsis. Journal of Cereal Science 1989; 10: 217–225.
34. Awika JM, Rooney LW, Wu X and Prior RL: Cisneros-Zevallos, L. Screening methods to measure antioxidant activity of sorghum (Sorghum bicolor) and sorghum products. Journal of agricultural and Food Chemistry 2003; 46: 5083-5088.
35. Awika JM & Rooney LW: Sorghum phytochemicals and their potential impact on human health. Phytochemistry. 2004; 65: 1199-1221.
36. Serna-Saldivar S & Rooney LW: Structure and chemistry of sorghum and millets. In: D.A.V. Dendy, Editor, Structure and Chemistry of Sorghum and Millets, American Association of Cereal Chemists, St Paul, MN 1995; 69–124.

37. Sweeny JG, Iacobucci GA: Synthesis of anthocyanidins-III: total synthesis of apigeninidin and luteolinidin chlorides. Tetrahedron 1981; 37: 1481-1483.
38. Kumar S, Rekha and Sinha LK: Evaluation of quality characteristics of soy based millet biscuits. Advances in Applied Science Research 2010; 1(3): 187-196.
39. Vijayalakshmi P and Radha R: Effect of little millet supplementation on hyperlipidaemia. Ind J Nutr Dietet 2006; 43: 469-474.
40. Seetharam A, Kadalli GG and Halaswamy BH: Results of front line demonstrations and technology for increasing production of finger millet and small millets in India. In: All India Coordinated Small Millets Improvement Project. ICAR, UAS, s GKVK, Bangalore 2001; 2-7.
41. Thilagavathy S and Muthuselvi: Development and evaluation of millets incorporated chappathi on glycemic response in type II diabetics. Ind J Nutr D 2010; 47: 42-50.
42. Debasis Mahata: Importance of buckwheat (*Fagopyrum esculentum* Moench). IJCS 2018; 6(5): 2121-2125.
43. Zhang L, Liu R and Niu W: Phytochemical and antiproliferative activity of proso millet. PLoS ONE 2014; 9: 104058.
44. Gopalan C, Ramasastri BV and Balasubramanian SC: Nutritive value of Indian Foods. National Institute of Nutrition (NIN). Indian Council of Medical Research Hyderabad 2004; 59-67.
45. Alfieri MAH, Pomerleau J, Grace DM and Anderson L: Fiber intake of normal weight, moderately obese and severely obese subjects. Obesity Res 1995; 3(6): 541-547
46. Vinoth A and Ravindhran R: "Biofortification in Millets: A Sustainable Approach for Nutritional Security." Frontiers in Plant Science 2017; 8(29): doi:10.3389/fpls.2017.00029
47. Gopalan C, Rama SBV and Balasubramanian SC: Nutritive Value of Indian Foods, National Institute of Nutrition, Indian Council of Medical Research Hyderabad India 2009; 99.

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