Millets: An underutilized grainsto ensure food security

Abstract

Reviving the interest inmillets as nutritious foods that can improve food and nutritional security and has the ability to reduce malnutrition is necessary. Millets are rich in various nutritious values such asfiber, proteins, thiamine and riboflavin, niacin, methionine, lecithin and vitamin E. They are also enriched in minerals namelyironcalcium, magnesium and potassium. Because of the nutritional value, it may help to prevent various types of diseases such as cancer, cardio vascular disease, lower blood pressure levels, stops the growth of tumours, lowering the rate of fat absorption, delays gastric issues and increases gastrointestinal bulk. They are also nutritionally similar or superior to major cereal grains. Millets possess some of the health benefits includes to protect heart health and reduce the effects of migraines, protect from diabetes, improve digestive system, lower risk of cancer, detoxify the body, boost respiratory health, optimize immune system, increase energy levels, and improve muscle and nerve health. Millets are a storehouse of nutrition by any nutritional parameter.

Keywords: Millets, food security, grains, nutrition

Introduction

High-energy meals such as millets or nutri-cereals were domesticated and grown as early as 10,000 years ago (Taylor, 2019). Millets are considered a major grain in the world, however they are the least used. Because millet grain is high in nutrients and phenolic compounds that are good for health (Hassan et al., 2021). Typically, marginal and degraded areas with little rainfall and low soil nutrient content are used for millets growth. A handful of millets is said to contain thousands of grains, as the name "millet" comes from the French word "mile," which means thousand (Singh et al., 2023). The purpose of millets, also known as mini millets, is to produce tiny kernels, which are the offspring of small Poaceae family grassland plants. Although they go by a different name, minor millets are significant crops because of their nutritional worth, therapeutic uses, ability to feed animals, and ability to survive a food crisis. (Yenagiet al., 2010).

Millets are a nutritious, locally grown grain that is high in bioactive compounds, low in GI, high in fiber, and a wonderful source of gluten-free protein. They also offer protection against diabetes and cardiovascular disease (Hassan et al., 2021).

The principal nutri-cereals farmed in India consist of pearl millet, also known as bajra (*Pennisetum typhoides*), finger millet, also known as mandua/ragi (*Eleusine coracana*), foxtail millet, also known as kangni (*Setariaitalica*), little millet, also known as kutki (*Panicum miliare*), kodo millet, known as kodo millet, sawan or barnyard millet (*Echinochloa frumentacea*), proso millet, also known as cheena (*Panicum miliaceum*), and brown top millet, also known as korale (*Brachiariaramosum*) (ICRISAT, 2017).In some Indian states, there have been multifaceted institutional initiatives focused on millets with the goal of boosting both rural and urban output. The Ministry of Agriculture and Farmers Welfare, GOI, refers to the very diversified group of grasses known as millets as Nutri-cereals. Tiny millets are all members of the Poaceae (true grass) family. Due to their tiny size, millet seeds thrive in arid environments (Tadele, 2016). It's a crop that can withstand drought and be kept pest-free for an extended period of time. It is best suited for dry culture; however, the labor-intensive cultivation process lowers its cultivation value. The world's largest producer is India. Pearl millet, the most widely grown type of millet, is a significant crop in regions of Africa and India (Tadele, 2016). While the overall amount of sorghum produced in India has grown recently, the amount produced on a small scale has decreased dramatically over the years, from 5.29 million hectares to 0.97 million hectares. In India, Karnataka is the state that produces the most foxtail millet. Although more than 58% of the world's output is millet, not many people are aware of its nutritional and health benefits (Upadhyaya et al., 2007).

It is crucial to investigate strategies for raising public knowledge of the nutritional advantages of millet. Exploring these underutilized/neglected species can contribute to sustainability, ecological diversification, rural people's economic empowerment, and nutritional and health security all of which the modern world desperately needs (McDonough *et al*., 2000). In recent years, there has been a growing global interest in rediscovering traditional and nutritious food sources. Among these, millets have emerged as a promising nutritional and agrarian solution to address the challenges of food production, especially in the face of climate

change.. This review explores the nutritional benefits, agrarian advantages, and the potential role of minor millets in ensuring food security.

Health Benefits and Nutritional Value of Millets

Millets are called as the cornerstone of nutrition. They are nutritionally similar or superior to major cereal grains. Millets possess some of the health benefits includes to protect heart health and reduce the effects of migraines, protect from diabetes, improve digestive system, lower risk of cancer, detoxify the body, boost respiratory health, optimize immune system, increase energy levels, and improve muscle and nerve health. Millets are a storehouse of nutrition by any nutritional parameter. Millets are miles ahead of rice and wheat in terms of their mineral content compared to rice and wheat. Each one of the millets has more fibre than rice and wheat. Finger millet has thirty times more calcium than rice. In their Iron content foxtail and little millet are so rich that rice is nowhere in the race.

Millets are amazing in their nutrition content. Each of the millet is three to five times nutritionally superior to the widely promoted rice and wheat in terms of proteins, minerals, and vitamins. Millets are a wide range of small-seed Nutri Cereals grown extensively in semi-arid regions. Millets are traditionally grown for their nutritional richness, low water requirement, low input requirements, and climatic resilience. India produces all the nine commonly known millets and is the largest producer and second largest exporter of millets in the world. Millet grains are rich sources of nutrients like protein, carbohydrates, dietary fiber, good quality fat and have substantially higher amounts of minerals like calcium, potassium, magnesium, iron, manganese, zinc, and B-Complex vitamins, making them a preferable choice over other cereal grains (wheat and rice) largely consumed by the populations in India. Millets are known sources of rich iron, calcium, antioxidants, and micronutrients.

Gluten-free protein, high fibre content, low glycaemic index and richness in bioactive compounds make them a suitable healthy food (Kannan *et al*., 2013). The average carbohydrates content of millets varies from 56.88 to 72.97 g/100 g(Leder, 2004). The Protein content of all the millets is comparable to each other with an average protein content of 10 to 11%, except finger millet, which has been reported to contain protein in the range of 4.76 to 11.70 g/100 g in

different studies (Singh *et* al., 2012). Finger millet protein is rich in essential amino acids like methionine, valine and lysine, and of the total amino acids present, 44.7% are essential amino acids**. (**Mbithi-Mwikya*et al*., 2000).The Nutritional Values of different Ingredients of our food is given in Table 1 and Comparative Nutritional Values of Millets in general and popular Indian Millets are given in Table 2.

Rich in Nutrients

Numerous vital components, including vitamins, minerals, and dietary fiber, may be found in abundance in millets, especially those grouped together in minor millets. These grains greatly contribute to a healthy diet by offering a nutritional profile that is well-balanced. Millets are nutritionally comparable to ordinary cereals, if not more so in terms of calories, protein, and macronutrient concentrations. Unlike rice and wheat, millets are a strong source of micronutrients such vitamins A, B, D, E, niacin, pyridoxine, antioxidants, iron, and zinc in addition to being high in calories and key nutrients like protein. Compared to rice and wheat, millets contain higher protein contents (10–12.3 g/100 g), fat contents (1%–5%), iron contents (0.5–19.0 mg), and calcium contents (10–410 mg) (Devi *et al*., 2014). They are a valuable complement to the diets of both humans and animals because of their high calorie content, calcium, iron, zinc, lipids, and quality proteins. They are also great sources of nutritional fiber and vitamins.

Gluten-Free Alternative: Millets is inherently gluten-free, making it an excellent alternative for individuals with gluten sensitivity or celiac disease. The rising prevalence of gluten-related disorders has increased the demand for gluten-free grains, positioning millets as a viable option.

Table 1: Comparing the nutritional makeup of millets with typical grains

Composition	**Rice**	**Wheat**	**Maize**	**Millets**
Protein (%)	7.5	14.4	12.1	7.3–14.5
Carbohydrates (%)	77.2	64	62.3	56.1–72
Fat (%)	2.4	2.3	4.6	1.3–5.1

Composition	Rice	Wheat	Maize	Millets
Dietary fibers (%)	3.7	12.1	12.8	7.0–37.8
Total phenols (mg/100 g)	2.51	20.5	2.91	51.4–368
Calcium (%)	0.02	0.04	0.03	0.01–0.33
Iron (%)	19	40.1	30	18–21.9
Zinc (%)	10	30.9	20	15–29.5
Sodium (%)	0.00	0.04	0.14	0.11
Thiamine (mg/100 g)	0.07	0.57	0.38	0.32–0.63
Riboflavin (mg/100 g)	0.03	0.12	0.14	0.05–0.22
Nicotinic acid (mg/100 g)	1.6	7.4	2.8	0.3–3.7

(Source: Devi *et al*., 2014)

Table 2: Comparative Nutritional Values of Selected Millets

Millets/Nutrient	Protein (g)	Fibre (g)	Minerals (g)	Iron (mg)	Calcium (mg)
Pearl/Kambu Millet	10.6	1.3	2.3	16.9	38
Finger/Ragi Millet	7.3	3.6	2.7	3.9	344
Foxtail/Tenai Millet	12.3	8	3.3	2.8	31
Proso/Panivaragu Millet	12.5	2.2	1.9	0.8	14
Kodo/Varagu Millet	8.3	9	2.6	0.5	27
Little/Samai Millet	7.7	7.6	1.5	9.3	17
Barnyard/Kuthiraivali Millet	11.2	10.1	4.4	15.2	11

Low Glycemic Index:

The low glycemic index of millets makes them suitable for individuals with diabetes. Millets can help regulate blood sugar levels, providing a steady release of energy and promoting better overall health.

Minerals and vitamins content in Millets

The minerals and vitamins are known as micronutrients as they are needed in petite amount. Minerals instigate in the building of bones, blood clotting, transmitting signals, keeping normal heart beat, cell energy production, transportation of oxygen, metabolize and synthesize fats and proteins, act as co-enzymes, provide immunity to the body and help nervous system work properly.

- **Calcium content**: Calcium content of finger millet is about eight times higher than wheat and being the richest source of calcium (348 mg/100 g) and it has the capability to prevent osteoporosis.

- **Iron content:** The iron content of barnyard millet is 17.47 mg/100 g which is only 10 mg lower than the needed daily value and their consumption can meet the iron demand of pregnant women suffering from anaemia.

- **Zinc content**: Foxtail millet contains loftiest amount of zinc (4.1 mg/100 g) among all millets and is also a good source of iron (2.7 mg/100 g) contributing an important role in boosting the immunity. (Soetan*et al*., 2012)

- **Vitamins:** Millets are also good source of β-carotene and B-vitamins especially riboflavin, niacin and folic acid.

Health benefits of millets

Millets have been traditionally used as a staple food in many parts of the world. They are rich in fibre, protein, vitamins, and minerals, and have been found to have several health benefits, including:

1. **Cardiovascular disease** (CVD) is a group of disorders that affect the heart and blood vessels, and includes conditions such as coronary artery disease, heart failure, and stroke. CVD is a major cause of death and disability worldwide, and several risk factors have been identified, including high blood pressure, high cholesterol, diabetes, and obesity. Millets have been found to have several properties that may be beneficial for reducing the risk of CVD, including:
    - High fiber content: Millets are rich in dietary fiber, which has been found to reduce cholesterol levels in the blood and improve overall cardiovascular health.
    - Low glycemic index: Millets have a low glycemic index, which means they do not cause a rapid increase in blood sugar levels, and may be beneficial for people with diabetes.
    - Antioxidant properties: Millets are rich in antioxidants, which help to reduce inflammation and oxidative stress in the body, both of which are risk factors for CVD.
    - Low in fat: Millets are low in fat, particularly saturated fat, which is a major risk factor for CVD.
    - Gluten-free: Millets are gluten-free, which makes them a suitable option for people with celiac disease or gluten intolerance.

    Overall, incorporating millets into a healthy and balanced diet may be beneficial for reducing the risk of cardiovascular disease. However, it is important to note that a balanced diet and regular physical activity are the most important factors in reducing the risk of CVD, and millets should be consumed as part of a varied diet.

2. **Celiac disease:** Millets are naturally gluten-free, which makes them a suitable food option for people with celiac disease.
    - Celiac disease is an autoimmune disorder that affects the small intestine's ability to absorb nutrients from food properly. When people with celiac disease consume gluten-

containing foods, their immune system reacts and damages the small intestine's lining, leading to a range of symptoms such as abdominal pain, diarrhoea, fatigue, and weight loss.

- Millets such as sorghum, foxtail millet, pearl millet, and finger millet are excellent alternatives to gluten-containing grains such as wheat, barley, and rye. These grains are high in fiber, protein, vitamins, and minerals and can be used to make a variety of dishes such as porridge, bread, pancakes, and even desserts.
- However, it's essential to ensure that the millets you purchase are certified gluten-free as some millets may be cross-contaminated with gluten during processing or transportation. It's also essential to read food labels carefully to avoid products that contain gluten-containing ingredients or were processed in facilities that handle gluten-containing products.
- In summary, millets are a great option for people with celiac disease looking for gluten-free grains to include in their diet. However, it's important to ensure that the millets you consume are certified gluten-free to avoid cross-contamination with gluten

3. **Diabetes:**

Millets are a good choice for people with diabetes as they are low in glycemic index, which means they are digested slowly and do not cause a rapid increase in blood sugar levels. Millets also contain complex carbohydrates, dietary fiber, and minerals like magnesium and potassium, which are important for people with diabetes.

- Foxtail Millet: It is a rich source of dietary fiber and has a low glycemic index. It also contains antioxidants that can help lower blood sugar levels.
- Finger Millet: It is rich in fiber and has a low glycemic index. It is also rich in phytochemicals like polyphenols and flavonoids, which have antioxidant properties.
- Barnyard Millet: It is rich in fiber, protein, and low in carbohydrates. It also has a low glycemic index and can help in managing blood sugar levels.
- Kodo Millet: It is rich in dietary fiber and has a low glycemic index. It is also a good source of protein and minerals like iron and calcium.
- Little Millet: It is rich in dietary fiber and has a low glycemic index. It is also a good source of protein and minerals like magnesium and potassium.

Climate Resilience

Millets are known for their adaptability to diverse climatic conditions. Minor millets varieties are particularly resilient to drought, making them a valuable crop in regions facing water scarcity. This resilience contributes to the sustainability of agricultural practices.

In addition, the current state of climate change is having a significant influence on natural resources and agricultural productivity, which in turn affects food production and livelihoods. For instance, FAO figures show that as of 2019, over 820 million people worldwide were still hungry, underscoring the tremendous challenge of reaching the Zero Hunger target by 2030. Two billion people worldwide experience moderate to severe food insecurity, which is another alarming fact (Jeena et al., 2020). Reorienting efforts toward sorghum and millets is now necessary in order to create demand for processed foods through value addition, technological diversification, nutritional assessment, and awareness-raising supported by backward integration. Given the current state of climate change, drought, and water scarcity, millets have emerged as a potentially viable and highly nutritious option for ensuring food security in a sustainable manner

Soil Health:

Millets are well-suited for sustainable farming practices. They require fewer inputs like water and synthetic fertilizers compared to conventional cereal crops. The cultivation of minor millets helps improve soil health, reducing the environmental impact of agriculture.

Crop Diversity and Biodiversity:

Integrating minor millets into agricultural systems promotes crop diversity, which is crucial for overall ecosystem health. Additionally, millet cultivation supports biodiversity by providing a habitat for various beneficial insects and microorganisms.Climate resilience and adaptability to diverse conditions. Reduced water and fertilizer requirements compared to conventional crops.

Affordability and Accessibility:

Millets are often more affordable than other grains, making them accessible to a broader population. Minor millets can play a crucial role in addressing food security challenges by providing a cost-effective and nutritious food source.

Community Empowerment:

The cultivation and consumption of millets can empower local communities, especially in rural areas. Supporting millet farming can contribute to thegrowth ofeconomic, thus reducing dependency on the external food sources.

The present Scenario National Millets Mission (NMM) was launched in the year 2007 to promote production and consumption of the millets. Regarding this, Karnataka has taken up many steps to popularize production and consumption of milletsin India. It set up cooperatives to streamline supply chain. Many millet based start-ups were also established to popularise its uses in the country. In Maharashtra, people have been consuming millets for many decades. Many processing units have established to provide the white millets (Ragi) within the communities. It is still one of the main staple crops in the state of Maharastra. Orissa Government had also initiated a special millets programme in tribal areas and introduced Odissa Millet Mission in 2017 for promotion of the millets. Chhattisgarh Government have been established State Millet Mission in 2021, aimed to boost the production, provide employment to the farmers, women groups, as well as youths. Rajasthan has been growing Bajra traditionally and is the largest producer of Bajra in India. But in the recent years the trend of consumption is decreasing. The tribal area in southern Rajasthan is known to have staple nutritious millet calledKutki but in the modern times these millets uses have been only limited to the old aged persons who had grown the crops in their kitchen gardens. The Prime Minister had highlighted the brainstorming sessions shall be held on topics such as millets farming, millets economy, health benefits and farmers income among others with active participation of Gram Panchayat, Krishi Kendras, colleges, schools, and agricultural universities along with Indian embassies and several foreign countries. He elaborated that milletsare not only limited to just food or the farming. Giving examples of minor millets such as Ragi, Sama, Kangni, Cheena, Kodon, Kutki, and Kuttu that are the prevalent in different regions of the India. The Prime Minister mentioned that millets hasbeen a part of lifestyle in India for many years. India government has introduced millets in Public Distribution System to make it easily accessible and affordable to the masses and Price Support Scheme (PSS) to provide financial assistance to farmers for the cultivation of millets.

Conclusion:

Millets, encompassing various millet varieties, present a holistic solution to the challenges faced by modern agriculture and nutrition. With its exceptional nutritional profile,

adaptability to diverse climates and positive impact on agrarian ecosystems, minor millets emerges as a sustainable and resilient option for addressing food production challenges. As we strive towards a more sustainable and inclusive global food system, the rediscovery and promotion of minor millets represent a promising step forward. Minor millet is emerging as a holistic development medium in India. It provides a gateway to prosperity for the country's tiny farmers. There are around 2.5 crore small farmers directly involved in the production of millets in India; therefore, increasing the market for millets will undoubtedly strengthen the rural economy. India is endowed with hundreds of nutritious crops whose research and development is still poorly addressed. Millets are storehouse of dozens of nutrition in large quantity and long term consumption of millets may bring several health benefits of the people hence they can help resist malnutrition. Production of millets has numerous securities such as securities of food, nutrition, fodder, fiber, health, livelihood and ecology and at the same time increase the development of vulnerable people.

The Way Forward

Millets are the store house in their nutrition content and different millets have their different features. These millets aid in the weight management, resisting malnutrition, controlling diabetic problems,blood pressure, etc. So, government should adopt some good techniques to increase the awareness and consumption of millet like providing incentives to the farmers to produce more millets at the low cost and support for procurement and its storage. Government can also open new markets for the millets and encourage research progress and development and productionof millets. Millets can also make available at ration shops at the lowest feasible price. To increase the consumption of millets ease of availability should be made explicitly among the children and young adults. Besides like the major cereals such as rice and wheat millets could be supplied in the Public Distribution System (PDS). The recommendation made by M.S. Swaminanthan accepted by the Government of India has to be properly implemented. Markets and entrepreneurship development through modern and innovative approaches coupled with storage and marketing facilities at village level. Proper advertisement strategies are necessary to increase awareness on the nutritional advantages and health benefits of millets. Lack of

awareness about millets and their health benefits can be addressed through Higher Education Institutions.

All the media can be broadcasted and exposed the importance of using millets which helps them to overcome the problems of malnutrition among children. People must have been awareabout the usage of millets through attending nutrition programs and the media campaign.

- Small farmers in the hilly regions and dry land plains the poorest households in rural India and shall be encouraged to cultivate the millets and that is possible only if it they get good returns.
- Adequate public support can also make the cultivation of millets more profitable, ensuring the supply for the PDS and ultimately provide nutritional benefits to the wide section of population.
- Improving the millets availability in the markets and making them more accessible to the consumers can encourage their consumption.
- Lack of awareness about the millets and their health benefits can also be addressed through the education and promotion in rural areas.
- The perception of millets as a poor man's food needs to be changed through the system of marketing and promotion. Improving the processing techniques and increasing availability of value added millet based products can make more appealing to the consumers.
- Collaboration between the farmers, processors and marketers can help in increase the supply and demand of millets.
- National Food Security Mission must be renamed as National Food Security and Nutrition Mission and Helping Startups with technical backstopping.
- Millets are often more expensive than the other staple grains, that makes them less accessible to low income consumers. Addressing the affordability through government subsidies or market interventions can increase its consumption.
- Millets being high in fibres, protein sand low Glycemic index and High in iron and vitamin C that helps in reducing anaemia, biofortification of millets measure shall be taken by IIMR, Central Food Technological Research Institute (CFTRI) & ICRISAT on health benefits and clinical pieces of evidence and Nutrition and bioavailability of nutrientsfocussing on diabetics, suitability for children, bone health and nutrition profiling.

- Recipe awareness Cooking workshops, Conference on Food processing interventions by industry, Workshops with dieticians, doctors, nutritionists, civil society and students shall be undertaken by Higher Education Institutions.
- Millet recipes food festivals under Eat Right India campaign, Marathons, Cyclothons, Millet Rural and Development on traditional or/and contemporary millet recipes by IIMR, National Institute of Food Technology and Entrepreneurship and Management (NIFTEM) with higher shelf life with proper packaging and branding and ready to use products.
- Millet based food through Mid Day Meal in schools andAnganwadis at least one day a week shall be given priority.
- Organizing events in the various groups (using NSS, NCC SHGs/FPOs), schools, colleges, universities, industry and civil societies.
- Defense Food and Research Lab should promote millets in Defense, Police forces & Canteens.

References

Devi PB, Vijayabharathi R, Sathyabama S, Malleshi NG, Priyadarisini VB. Health benefits of finger millet (Eleusine coracana L.) polyphenols and dietary fiber: A review. J Food Sci Technol. 2014;51:1021–40.

Gangaiah. 2008. Agronomy- Kharif Crops Finger Millet.

Hassan, Z. M., Sebola, N. A., &Mabelebele, M. (2021). The nutritional use of millet grain for food and feed: a review. Agriculture &Food Security, 10(1). https://doi.org/10.1186/s40066-020-00282-6.

http://nsdl.niscair.res.in/jspui/bitstream/123456789/527/1/Millets%20(Sorghum,%20Pearl%20Millet,%20Finger%20Millet)%20-%20%20Formatted.pdf. Accessed 10 April 2023.

ICRISAT. (2017). Small millets. Retrieved from http://www.icrisat.org/ homepage.

International Rice Research Institute (IRRI). 2015. Steps to successful rice production. Rice production manual, Los Banos (Phillipines); www.knowledgebank.irri.org. Accessed 10 April 2023.

Kannan, S.M., Thooyavathy, R.A., Kariyapa, R.T., Subramanian, K, Vijayalakshmi, K. 2013. Seed production techniques for cereals and millets. In: Vijayalakshmi K, editor. Seed node of the revitalizing rainfed agriculture network Centre for Indian knowledge systems (CIICS). p. 1-39. http://www.ciks.org/downloads/seeds/5.%20Seed%20Production%20Techniques%20for%20Cereals%20and%20Millets.pdf. Accessed 10 April 2023.

Laishram, B., Dutta, R., Devi, O. R., &Ngairangbam, H. (2023). Importance of millets for food and nutritional security in the context of climate resilient agriculture. Advances In Agronomy Vol. 1,

Leder, I. 2004. Sorghum and Millets. Cultivated plants, primarily as food sources. In: Gyargy F, editor. Encyclopedia of life support systems, UNESCO, Eolss Publishers, Oxford.

Mbithi-Mwikya, S., Ooghe, W., Van Camp, J., Nagundi, D., Huyghebaert, A.2000. Amino acid profile after sprouting, Autoclaving and lactic acid fermentation of finger millet (Elusine coracana) and kidney beans (Phaseolus vulgaris L.). J. Agric. Food Chem. 48: 3081-5.

McDonough, C.M., Rooney, L.W. and Saldivar, S. (2000). The millets. In K. Kulpand& J. G. Ponte, Jr. (Eds.), Handbook of cereal science and technology (pp. 177–195). New York, NY: Marcel Dekker Inc.

Singh, P., Raghuvanshi, S.R. 2012. Finger millet for food and nutritional security. Afr. J. Food Sci. 6: 77-84

Singh, S., Yadav, R. N., Tripathi, A. K., Kumar, M., Kumar, M., Yadav, S., Kumar, D., Kumar, S., & Yadav, R. (2023). Current status and promotional Strategies of Millets: a review. International Journal of Enviornment and Climate Change, 13(9), 3088–3095. https://doi.org/10.9734/ijecc/2023/v13i92551.

Soetan, K.O., Olaiya, C.O., Oyewole, O.E. 2010. The importance of mineral elements for humans, domestic animals and plants—a review. Afr. J. Food Sci. 4(5):200–22.

Taylor, J. R. (2019). Sorghum and millets. In Elsevier eBooks (pp. 1–21). https://doi.org/10.1016/b978-0-12-811527-5.00001-0.

Upadhyaya, H.D., Gowda, C.L.L., Reddy, V.G.(2007). Morphological diversity in finger milletgermplasm introduced from Southern and EasternAfrica, The Journal of Semi-Arid TropicalAgricultural Research. 3: 1-3.

Yenagi NB, Handigol JA, Ravi SB, Mal B, Padulosi S (2010) Nutritional and technological advancements in the promotion of ethnic and novel foods using the genetic diversity of minor millets in India. Indian J Plant Genet Res 23(1):82–86.