



RESEARCH ARTICLE

A REVIEW ON HEALTH BENEFITS OF RAGI (FINGER MILLET) IN RELATION TO AYURVEDA AND MODERN NUTRITION

Garima Yadav¹ and Dr. Kanchan Chowdhury^{2,*}

¹Garima Yadav, PhD Scholar, Dept. of Swasthavritta and Yoga, Faculty of Ayurveda, Institute of Medical Science, Banaras Hindu University, Varanasi; ²Dr. Kanchan Chowdhury, Assistant Professor, Dept. of Swasthavritta and Yoga, Faculty of Ayurveda, Institute of Medical Science, Banaras Hindu University, Varanasi,

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*Corresponding author:
Dr. Kanchan Chowdhury

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ABSTRACT

Background: Millet is often referred to as a "nutri-cereal" because it is a nutritious whole grain that offers a range of health benefits. Millets are a group of small-seeded grasses that have been cultivated for thousands of years and are a staple food in many parts of the world, especially in Africa and Asia. Some common types of millets include sorghum, pearl millet, finger millet, foxtail millet, and proso millet. In Ayurveda, millets are recognized for their nutritional value and health benefits. Ragi, also known as finger millet, is a nutritious grain that holds significance in Ayurveda as well as in modern nutrition. Finger millet (ragi), are considered detoxifying in Ayurveda and they are believed to help eliminate ama (toxins) from the body. **Method and Material:** This review paper has been taken from different *Ayurvedic* classical text books such as Charak Samhita, Bhavprakash, Ahara dravygunkarmasangraha etc. and various modern and *Ayurvedic* research paper from PubMed, Google scholar, SCI etc. **Aims and Objective:** Millets are gaining more attention these days but its significance according to Ayurveda is still unknown by people. The purpose of the study is to highlight the nutritional and health benefits as well as therapeutic potential of Finger Millet in Ayurveda and Modern Nutrition. **Discussion & Conclusion:** Millets are highly nutritious grain, having multiple health benefits as well as they contribute to food and nutritional security of the country. They are referred as Nutri-cereals due to having number of nutrients which is required for normal functions of the human body. Ragi is high in fibre, is gluten free, having low glycemic index.

INTRODUCTION

Millets are one of the world's most ancient crops (first crops) to be domesticated by human in Asia and Africa, but their significance and cultivation reduced due to large-scale rice and wheat cultivation because to urbanisation and industrialization.¹ They are a type of small-grained cereal food crop that is extremely nutritious. The majority of millet crops are native to India and are generally known as Nutri-cereals as they contain almost all of the nutrients essential for normal human body functioning. They are rain-fed crops that are grown in low-rainfall areas, resuming increased importance for sustained agriculture and food security. Millets are commonly referred to be famine crops since they are the only crops that can ensure harvests in times of extreme scarcity of food in a region that can cause death. Previously, these crops were known as orphan crops since they were only one option for production because they have less demand in the Underdeveloping millets market and produced lesser profits than other crops. However, these underutilised crops have significance since they contribute to the means of livelihood, food, and nutritional security of the poor in various regions of the world, as well as diversifying our food basket.¹

Millets are classified as major and minor millets on the basis of area grown and their grain size. Pearl millet (Bajra) and Sorghum (Jowar) comes under major millets. The minor millet includes Foxtail millet (Kangni/Italian millet), Proso millet Cheena/common millet), Finger millet (Ragi, mandua), Little millet (Kutki), Kodo millet, Barnyard millet (Sawan/Jhangora) and Brown top millet (Korale). In Ayurvedic classical text millets are included under Kudhanya, derived from Kutsitadhanya, which means that which is contemptible. Traditional food systems play an important part in preserving people's well-being and health. Millets were among the first crops to be cultivated and consumed by humans. Millets were consumed by the Indus Valley people (3,000 BC), and various types that are today produced around the world were first farmed in India. In Yajurveda Foxtail millet is referred to Priyangava, Barnyard millet is as Aanava, and black finger millet is mentioned as Shyaamaka, and indicated that millet consumption was widespread and predates the Indian Bronze Age. The seed coat forms part of the food and offers nutritional and health benefits.²

Finger Millet (Ragi/Mandua): Finger millet, often known as 'Ragi' and in Ayurveda it is mentioned as 'Mandua', belongs to family Poaceae, genus *Eleusine* and species *E. coracana*, is one of the most significant millets grown in many parts of Africa, mainly grown in Africa's eastern regions such as Kenya, Tanzania, and Uganda as

well in rawanda, Sudan, Ethiopia, Zimbabwe, Malawi and and Zambia it grown in smaller quantity. In India, it is grown in Bihar, Uttar Pradesh, Karnataka, Andhra Pradesh and Tamil Nadu) as well in Nepal.³ It ranks sixth in India After wheat, rice, maize, sorghum, and bajra.⁴

Nutritional Properties: Millets are additionally upscale sources of nutritional, nutraceutical and health promoting properties, having riboflavin, thiamine, iron, isoleucine, methionine, phenylalanine, leucine, and other essential amino acids also. These properties of finger millet making it a powerhouse of health benefiting nutrients like antitumorigenic, anti-diabetic, anti-ulcer, atherosclerogenic effects, antioxidants, which are mainly due to its contents of polyphenol and dietary fiber.² It is a good source of calcium, which helps to strengthen bones and teeth. Finger millet may provide health benefits for persons of all ages, especially those with chronic diseases.⁵ Zinc (Zn), amino acids (AA), and vitamin B complex are present in finger millet. This grain has the largest amount of carbohydrates, protein, fat, and crude fibre (Saleh et al., 2013).⁶ Ragi includes antioxidants such polyphenols that protect the body from degenerative disorders (Udeh et al., 2017).^{7,8} It is used in the production of weaning foods, traditional beer, and extruded products (Shobana et al., 2013).⁹ Naked caryopsis of finger millet with a brick red seed coat is often used as a whole meal in traditional cuisine dishes such as roti, muddle, and ambali (thin porridge). In epidemiological studies, regular consumption of whole grain cereals and their products has been found to reduce the risk of diabetes mellitus, gastrointestinal illnesses, and cardiovascular hazards. When millets are used as whole grains, key elements such as dietary fibre, minerals, phenolics, and vitamins that are concentrated in the outer layer of the grain or the seed coat become a part of the food and provide nutritional and health advantages.

Finger millet (Ragi) in Ayurveda: *Kshudra Danya* (i.e. Millet) is a category of small seeded cereals that have long been utilised as human sustenance. Many traditional diets are made up of millets mentioned in Bhavprakash and other classical text books. Millet has been grown for thousands of years.¹⁰ They are mentioned in Ayurvedic classical text books in the form of Trinadhanya and Kshudradhanya. In Charak Samhita, they are referred to the Dhanyavarga as Shyamak and Koradusha. In Rasa, these are Kasaya and Madhura, and Sheeta is their Veerya. They enhance Vata while balancing Kapha, Pitta, Ruksha (Dry), and Grahi (Absorbant) and are easy to digest.¹¹ Kshudradhanya have Rasopanchaka (therapeutic properties) such as Ushna, has Kashaya and Madhura Rasa, Katu Vipaka, Sheeta Virya, Ruksha and Laghu Guna, lekhan Karma, Vatakaraka and Grahi it also lowers Pitta and Kapha, according to Bhavprakash¹²

Therapeutic Properties of Finger Millet According to Ayurveda¹³

Name in Hindi	Mandua/Ragi
Sanskrit Name	Madhulika
English Name	Finger Millet
Rasa	Kasaya (Pungent), Sweet(Madhur)
Guna	Ruksha (Dry)
Virya	Ushna (Hot)
Vipaka	Katu (Bitter)
DoshaKarma	Katu (Bitter)
Dhatukarma	Kaphashamak, Vatapittavardhak

Ahara Kalpana of Ragi

Ragi Drink: Ragi drink is a kind of spicy drink prepared by using ragi flour along with buttermilk and fine chopped green chilli, ginger, some fresh chopped coriander leaves, salt (according to taste).

Health Benefits of Ragi Drink: Ragi is also known as Nachani, Sollu or sattenavu is rich in calcium, iron, protein and some rare nutrients such as Vitamin-B methionine. Rich in calcium, improves digestion, reduces weight.



In Ayurveda, it is mentioned in Bhavprakash that takra is ruchikarak, agni-pradehak, digestive, beneficial for the gut health.

Ragi Roti: Ragi roti is very popular in India. It is balakarak, ruchijanak, vatanashak, kaphakarak and guru.



Ragi Peetha (Farra): Ragi Peetha is made by using ragi flour and Bengal gram. This recipe is steamed and very healthy as well as delicious having spices and flavour.



Table 1.1. Ayurvedic Properties of the ingredients of Ragi Drink¹⁴

Ayurvedic Properties of Ragi Drink							
Ingredients	Synonyms	Rasa	Guna	Virya	Vipaka	Doshakarma	DhatuKarma
Buttermilk	Takra/ Chhachhik/Butter Milk	Mdhura (Sweet), Amla (sour)	Laghu	Sheeta	Madhura	Pittashamak	ShramaTrishna Nashak ¹⁵
Ragi	Madua/Ragi/Madhulik/ Finger Millet	Kasayanurasa (Pungent),MadhuraSweet	Ruksha	Ushna	Katu	Kaphashamak, Vatapittavardhak/	Mutra- Alpakar ¹⁶
Corianderleaf	Dhaniya/Dhanyak/Coriander eaves	Sweet (Madhura), KasayanurasaPungent),Katu (bitter), (Tikta), Kasaya (Astringent)	Laghu, Snigdha	Ushna	Madhur	Tridoshamak, Patra (Pittashamak)	Deepan, Rochan, Pachan, Anuloman, Raja pradah, Adhyaman-Chhardi-Shul-Krimi Nashak ¹⁷
Rock Salt	Saindhav, Rock Salt	Salty (lavan)	lghu, snigdha, sukshma	Sheeta	-	Tridoshashmak	Vrshya, swadu, deepan, pachan, rchan, avidahi, chachhushya, hridya, vran-malstambha-hridroga nashak ¹⁸
Onoin	Palandu	Madhur (Sweet), Katu (Bitter)	Guru, Tikshna, nigdha	Sheeta	Madhura	Vatashamak, Kichitkaphapittavardhak	Balya, deepan, rochab, brimhana, mutrajanana, shukradourbalya-nidra karak ¹⁹

Table 1.2. Ayurvedic Property of Ragi Roti

Rasa	Guna	Virya	Vipaka	Doshakarma	Doshakarma
Pungent (Kashaya), Sweet (Madhur)	Ruksha	Ushna	Katu	Kaphashamak, Vatapittavardhak	Mutra- Alpakar

Table 1.3. Ayurvedic Properties of the ingredients of Ragi Ragi Farra¹⁴

Ayurvedic Properties of RagiFarra						
Ingredients	Rasa	Guna	Virya	Vipaka	Doshakarma	Doshakarma
Ragi/Finger millet/Madua	Ruksha		Ushna	Katu	Kaphashamak, Vatapittavardhak	Mutra- Alpakar
Bengal Gram (Chana Dal), Chanak, Bengal Gram	Sweet (Madhur), Pungent S(Kashaya)	Guru, ruksha,	sheet	-	Pitta-kaphashamak, vatavardhak, ghreyukta, tridoshamak	Punsatvahar, vishtambh, virukshana, jwaraghna, rktapittahara ²⁰
Aesophoetida(Hing/Hingu)	Pungent (Katu)	Easy to digest (Laghu), unctuousness (snigdha),	sar, tikshna	Ushna	Vatakaphashamak, pittavardhak	Balya,deepan,rochan, anuloman, chhedan, chachhushya, hredya, aartavajnan, shool-gulma-udar-ajeernaadhyaman-aanah-vibandha-shwas-kaas-krimi-murchha-apsamar nashak ²¹

DISCUSSION

Millets, also known as "Nutri-Cereal," have been cultivated for hundreds of years and are a staple food in many regions. These days, due to its nutritional value and health benefits they are gaining popularity. Millets are rich in minerals and phytochemical content, and they constitute an essential part of food in many Asian and African countries. According to study of all the grains, millet has the lowest cost of agricultural production (Hasan et al. 2021).²² Prior research on millets has demonstrated their therapeutic potential because of antioxidant activity. Millets contain bioactive substances that may lower the risk of several kinds of illnesses, including cancer, diabetes, cardiovascular disease and high blood pressure. (Sharma et al., 2021).²³ According to the study of Liang & Liang (2019)²⁴ apart from their nutritional benefits, millets have antioxidants such as flavanoids, tannins, and phenols. Because Indian millets are high in protein, vitamins, and minerals, than wheat and rice. They are highly rich in nutrients and bioactive components.

They are excellent for those with diabetes or celiac disease because they are low in glycemic index and gluten-free. India is one of the top 5 millets exporters in the world. World export of millet has increased from \$400 million in 2020 to \$470 million in 2021 (ITC trade map) India exported millets worth \$64.28 million in the year 2021-22, against \$59.75 million in 2020-21. Value-added products made from millet have a very small share. They are highly rich in nutrients and bioactive components.

Millets are referred to as Trina Dhanya (grains made from grass), Kudhanya (lowest among grains), Kshudra Dhanya (small-sized grains) etc. in classical Ayurvedic classical text. The lifestyle disease may be reduced by the qualities, mode of actions and indications of Kshudra Dhanya(millet). It's thought that these maintain the doshas of bio-energies (doshas) in balance. One of the oldest millets in India is finger millet, often known as ragi and this review highlight its antiquity focuses on its history, utilization, nutrient composition, processing and health benefits. Of all the cereals and millets, finger millet has the highest amount of calcium and potassium. It has high amount of dietary minerals, fiber and sulphur containing amino acids. According to Ayurveda, it balances doshas and maintains health. One of Ayurveda's unique concepts is Ahara Kalpana, or food preparation. The properties of a Dravya (substance /food article) can be altered with the help of Kalpana. According to Acharya Charaka, Ahara Kalpana fulfils both the purposes of Ayurveda, such as Rugna (sick) and Swastha (healthy person). It comprises the choice and preparation of food items based on the particular demands of patients and conventions from specific Dravyas. Preparations prepared from ragi in this article such as Ragi drink, Ragi roti and Ragi peetha is highly nutritious and pathya for the individual health.

CONCLUSION

Millets are a group of highly nutritious, drought-tolerant, millets are mostly cultivated in India's arid and semi-arid regions. These grasses

are small-seeded members of the Poaceae family. They are an essential part of India's ecological and economic security and provide millions of resource-poor farmers with food and fodder. "Coarse cereals" or "cereals of the poor" are other names for these millets. Ayurveda principles are based on the theory of trayoupstambha (three pillars) i.e., ahara (diet), nidra (sleep), brahmacharya (to act with more awareness and with more conscious decisions). Millets are best used in SantarpanajanyaVikara (diseases due to excessive nutritional (carbohydrate, protein and fat diet) and Kapha-Pitta DoshajaVikara. Sridhanya are commonly called Kshudradhanya(used as staple food-as an alternative food than main cereals) or Mota-anaj(commonly used in rural areas- big sized or used all millets used as a mixture) or paramparikdhanya(known for traditional food) or Kudhanyaseveral millets rich content but needs much energy for emulsification-these dhanya consume more jathragini- fire+ water- to digest and to metabolize) or trinadhanya (trinadiverga- grass derived cereals and these have short term life span)For millennia, millets were introduced in ancient texts, Rigveda, Yajurveda and Atharvaveda. Ancient texts have mentioned about the common consumption of millets. Ragi (Eleusine coracana L.) is native to Africa region.

Finger millet (Ragi) is classified as major millet. Ragi (nartaki) has medicinal properties due to presence of Madhur and Kashaya rasa, Guru guna, Sheet virya which has therapeutic potential to cure diseases. It was introduced in India during second millennium BC through trading via sea from Africa. It is extremely tolerant to prolonged period of drought and moisture scarcity increases their importance in food security. It is normally consumed in the form of flour based product, rice, upma etc. it is highly nutritious and having therapeutic potential to cure disease. Beside of these it is necessary to explore study to understand their potential contribution to health and diseases, sustainable agriculture and global food security. Integrating millets into dietary patterns may provide a valuable means for promoting health and addressing present (contemporary) nutritional challenges. Further research and exploration are warranted to fully understand their potential contributions to human health, sustainable agriculture, and global food security. This article presents the therapeutic and nutritional potential of finger millet according to both modern nutrition as well as Ayurveda through ahar kalpana.

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