

A review on Ragi, a calcium-rich food

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Abstract :

The nutrient-dense cereal ragi, sometimes referred to as finger millet, has become well-known for its remarkable calcium concentration. This historical grain is a great nutritional option for anyone looking to strengthen their bones and avoid calcium shortage because it is high in calcium and other key elements. Ragi's general health advantages include being a good source of calcium, dietary fibre, iron, and antioxidants. Ragi is an excellent food for supporting skeletal health because of its high calcium content and bioavailability, particularly in individuals at risk for osteoarthritis and other bone-related conditions. The nutritional composition of ragi, highlighting its high calcium content, and investigates its possibilities as a useful food to enhance bone strength in both rural and urban areas. Ragi's adaptability to different culinary styles adds to its allure as a nutrient-dense, sustainable food source for a range of diets. Ragi is a great way to manage metabolic diseases like type 2 diabetes, cardiovascular wellness, and digestive health because it is a rich source of calcium as well as other vital nutrients including dietary fibre, protein, iron, and antioxidants. Because the grain is gluten-free, people with coeliac disease or gluten sensitivity can eat it. This essay investigates the nutrient profile of ragi, emphasising both its wider health advantages and its function as a calcium powerhouse. Additionally, ragi's adaptability to a variety of culinary preparations, including flour, breakfast cereal, and snacks, emphasises its possibilities as a sustainable, useful food for enhancing general health and wellbeing. Public

health could be greatly improved by ragi consumption, especially in areas where calcium deficiencies is common.

Keywords: *Calcium, dietary fibre, Gluten-free, Bone health, Osteoporosis, Metabolic diseases, Functional food, Environmentally friendly foods, Bioavailability*

Introduction

Millet is a little cereal that belongs to the Poaceae family of grasses. These are annual cereal grasses with tiny seeds that thrive in less fertile soil. Many of them are suited to tropical and desert environments. According to Gopalan, Rama Sastri, & Balasubramanian (2009); Hulse et al. (1980), millets include sorghum (Jowar), pearl millet (Bajra), finger millet, (Ragi), foxtail grain (Kakum), proso millet (Chena), tiny millet (Kutki), kodo wheat (Kodon), barnyard millet (Sanwa), and brown top millet (Kutki), kodo millet (Kodon), barnyard millet (Sanwa), and brown top millet (Gopalan, Rama Sastri, & Balasubramanian, 2009; Hulse et al., 1980; <http://www.swaraj.org/shikshantar/millets.pdf>; Accessed on 27.03.12). In many parts of India, ragi, also known as finger millet, is a common millet. Known by several names throughout Africa and as Koracan in Sri Lanka, it has long been a staple millet grain in regions of eastern and central Africa as well as India. (FAO, 1995)

In India, finger millet was traditionally processed using techniques like grinding, malting, and fermenting to create drinks, porridges, roti (unleavened flat bread), dosa (Indian fermentation pan cake), and idli (Indian fermentation steamed cake). (Malathi & Nirmalakumari, 2007) Consuming whole grain foods and cereal fibre appears to be negatively correlated related BMI, waist circumference, overall cholesterol levels, metabolic syndrome, cardiovascular disease mortality, insulin resistance, and type 2 diabetes incidence, according to research findings. (de Munter, Hu, Spiegelman, Franz, & van Dam, 2007; Newby et al., 2007; Pereira et al., 2002; Sahyoun, Jacques, Zhang, Juan, & McKeown, 2006) The popular polished white rice is not as nutritious as whole-grain grains like brown rice and millet. Research has also demonstrated

that among urban South Asian Indians, a higher consumption of refined grains like white rice and dietary glycaemic load – a measure of the quantity and quality of carbohydrates – were linked to an increased risk of type 2 diabetes with metabolic syndrome.(Mohan et al., 2009; Radhika, Van Dam, Sudha, Ganesan, & Mohan, 2009)

Low glycaemic index (GI), a metric for the quality of carbohydrates, foods and diets have been shown in numerous studies to be useful for the nutritional treatment of diabetes and a number of other chronic illnesses. Low GI foods typically lower the rate of glucose absorption, which lowers the need for insulin (Augustin, Franceschi, Jenkins, and Kendall, & Vecchia, 2002). In overweight South Asian Indians, a calorie-restricted diet with a considerably decreased carbohydrate content was also found to be beneficial in reducing insulin resistance along with different metabolic abnormalities (Backes et al., 2008).By including whole, ancient grains like the sorghum and millet like finger millet into contemporary Asian Indian diets, Dixit, Azar, Gardner, and Palaniappan (2011) have provided workable solutions to lessen the burden of chronic disease. Kannan (2010) has talked on the many health and nutritional advantages of millet, particularly its capacity to avoid chronic illnesses. Sadly, a large number of traditional Indian grains, such as millets, have not undergone the proper GI evaluation. Furthermore, there is a dearth of low-GI food development and availability, particularly in India with regard to millet. Given that finger millet is inexpensive, has a greater dietary fibre content, and contains a number of vitamins and phytonutrients with almost any negative effects reported, it merits consideration.In ancient Indian literature written in Sanskrit, finger millet, which was one of the country's earliest crops, is called "nrttakondaka," which translates as "Dancing grain." It was also known as "rajika" or "markataka" (Achaya, 2009). The first known mention of finger millet dates to around 2300 BC and originates from Hallur in Karnataka, India (Singh, 2008).Known by many names, including "umi" in Bihar and "nachni" (meaning dancer) in Maharashtra, the finger millet was once a widely grown plant in many Indian regions. The grains were crushed, sieved, and occasionally gently toasted after sprouting and

drying. Either salted or sweetened, the reddish flour (going from red finger millet) was consumed as a ball or gruel. Another popular weaning food was finger millet (Achaya, 2009). Red finger millet is referred to as "Kelvaragu" in the ancient Tamil text "Kuruntogai." "Purananuru," a passage from Sangam Tamil literature (600 BC–200 AD), describes how finger millet grains are dried, husked, and cooked. Poets in ancient India were fed finger millet boiled in milk with honey (Achaya, 1992). Karnataka has been using it since then. The National Nutrition Monitoring Bureau (NNMB, 2006) reported that while consumption of millets was nearly zero in the states of Kerala, West Bengal, Orissa, and Tamil Nadu, where rice is the main staple, it was higher in Gujarat (maize, pearl millet), Maharashtra (sorghum), and Karnataka (finger millet). In comparison to Karnataka (75 g/CU/day), Madhya Pradesh (32 g/CU/day), and Andhra Pradesh (16 g/CU/day), Gujarat and Maharashtra consumed more millets (200 and 132 g/CU; a consumption unit is a coefficient, and 1 CU corresponds to an energy requirement of 2400 kcal/day of an Indian male performing sedentary work). Orissa (1 g/CU/day) and Tamil Nadu (3 g/CU/day) demonstrated very low levels of consumption. The primary botanical constituents of the millet kernels are the endosperm, embryo (germ), and seed coat. Although there are varieties that are yellow, white, tan, red, brown, or violet in colour, only the reddish-colored ones are widely grown across the globe. The millet's outermost layer, known as the pericarp, has minimal nutritional value. One of the potential explanations for finger millet's increased dietary fibre content could be because its seed coat, or testa, is multilayered (five layered), which sets it apart from other millets including sorghum, pearl millet, proso millet, and a foxtail (FAO, 1995). **Nutritional Content of Finger Millets**

Finger millet is a high-carbohydrate grain that also contains dietary fibre (11.5%), free sugars (1.04%), starches (65.5%), and non-starchy carbohydrates (Malleshi, Desikachar, & Tharanathan, 1986). The carbohydrate profile of a few finger millet cultivars was examined by Wankhede, Shehnaj, and Raghavendra Rao (1979a), who found that the starch content ranged from 59.5 to 61.2%, the pentosans from 6.2 to 7.2 percent, the cellulose from 1.4 to 1.8%, and the lignins from

0.04 to 0.6%. Compared to brown rice, polished rice, and all other millets, including foxtail, tiny, kodo, and barnyard millet, finger millet has a significantly greater dietary fibre level (11.5%). Finger millet has a lower carbohydrate load than polished rice, although it is similar to wheat. Amylose and amylopectin are components of finger millet starch. Compared to other millets as sorghum (24.0%), pearl millet (21.0%), proso millet (28.2%), the foxtail millet (17.5%), and kodo millet (24.0%), finger millet starch has a lower amylose concentration (16%) (Wankhede, Shehnaj, & Raghavendra Rao, 1979b) (FAO, 1995). During chilling (from 930 to 500 C), finger millet (Purna variety) starch exhibited the highest set back viscosity (560 BU), indicating a propensity for retrogradation (Wankhede et al., 1979b).

The primary components of finger millet protein are called prolamins (Virupaksha, Ramachandra, & Nagaraju, 1975). Compared to milled rice, finger millet has higher concentrations of sulfur-containing amino acids, specifically cystine and methionine. The tannin content of finger millet has an impact on its protein digestibility (Ramachandra, Virupaksha, & Shadaksharaswamy, 1977). But according to Subrahmanyam, Narayana Rao, Rama Rao, and Swaminathan (1955), an adult human's phosphorus (8.7% P), calcium (3.0% Ca), and nitrogen (10.4% N) balance may be maintained with a diet high in finger millet and pulses. According to Doraiswamy, Singh, and Daniel (1969), adding lysine or leaf (lucerne) protein to finger millet diets enhanced children's nutritional status, actual protein digestion, and N retention. In their study, Pore and Magar (1976) found that the B-11 variety of finger millet-based diet had a protein efficiency ratio (a measurement of the quality of protein in terms of weight gain per quantity of protein taken) of 0.95, while the control casein diet had a ratio of 1.9. **Micronutrients**

According to Mahadevappa and Raina (1978), seven breeding variants of finger millet have 1.85–2.10% total lipids. The lipid content of finger millet is 70–72% neutral lipids, primarily triglycerides with trace amounts of sterols, 10–12% glycolipids, and 5–6% phospholipids. Lipids often comprise 20–35% palmitic acid, 8–27% linoleic acid, 46–62% oleic acid,

and trace amounts of linolenic acid. The fat level of finger millet is lower than that of pearl millet, barnyard millet, tiny millet, and foxtail millet. This lower lipid content may be one of the reasons why finger millet has superior storage qualities than other millets. **Finger Millet as a High Calcium Food**

In addition to having 283 mg% phosphorus, 3.9 mg% iron, and numerous other trace minerals and vitamins, finger millet has an extraordinarily high calcium content (344 mg%) when compared to every other cereals and millets (eight times greater than pearl millet) (Gopalan et al., 2009). In addition, finger millet has a higher potassium level (408 mg%) than other grains and millets. There have also been reports of high calcium finger millet variations elsewhere; according to Umapathy and Kulsum (1976), the “Hamsa” variety had significantly higher calcium levels (660 mg%). Compared to common (proso) millet, finger millet has a reduced phytic acid concentration. Platel, Eipeson, and Srinivasan (2010) also noted that when finger millet was malted, the bioaccessibility of minerals (iron, manganese) rose. While popping finger millet reduced calcium bioaccessibility while increasing iron and zinc bioaccessibility, decorticating finger millet lowered total mineral contents while increasing calcium, iron, and zinc bioaccessibility. Calcium, iron, and zinc became more bioavailable when finger millet was malted (Rateesh, Usha, & Malleshi, 2012). In addition to preserving the positive nitrogen balance, a research on girls aged 9 to 10 revealed that switching from rice to finger millet increased calcium retention (Joseph, Kurien, Swaminathan, & Subrahmanyam, 1959).

The mineral calcium (Ca) is necessary for the body to perform numerous vital processes as well as to form and maintain strong bones. Finger millet has 398 mg of calcium. The main health advantages of calcium include preventing hypertensive problems during pregnancy, regulating blood pressure, forming bone, and preventing colonrectal adenomas (Cormick and Belizán, 2019). Teeth and bones contain the mineral phosphorus (P). Finger millet has 320 mg of phosphorus. Phosphorus deficiency in healthy individuals results in calcium being released from the bones,

hypercalciuria, and the absence of hypercalcemia. Long-term phosphorus deprivation and hereditary hypophosphatemia are common causes of rickets or osteomalacia (Takeda et al., 2012).

The body needs iron (Fe) as a mineral for its development and growth. The iron concentration of finger millet is 3.9 mg. The most common micronutrient shortfall in the world is iron deficiency (ID), and young children are especially at risk because of their rapid development, which calls for high iron needs. Anaemia is another symptom of iron deficiency (Domellof et al., 2014). An element that is necessary for human bodily functions is magnesium (Mg). The 137 mg magnesium found in finger millet. Magnesium helps activate vitamin D, which controls the equilibrium of calcium and phosphate and affects bone growth and preservation. 398 mg of calcium (Ca) is required for heart muscle, bone formation, blood cell synthesis, and blood cell function.

Conclusion

Ragi is a great complement to a balanced diet because it is high in calcium and has several health advantages. Because of its high calcium content, it helps to avoid diseases like osteoporosis and supports healthy bones and teeth. Furthermore, ragi is a fantastic source of vital minerals like iron, fibre, and antioxidants that promote heart health, control blood sugar, and support digestive health. Amino acids, such as methionine, are also necessary for development and repair. Ragi is a potent, nutrient-dense food for people of all ages, and by including it in your diet, you may improve overall nutrition, promote bone health, and efficiently manage weight.

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