WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.084
Volume 13, Issue 6, 272-279. Review Article ISSN 2277–7105

UTILITY OF FINGER MILLET (RAGI) IN POST MENOPAUSAL OSTEOPOROSIS: A REVIEW

Shraddha Dube[1]*, Shilpa Varade[2] and Dr. Vinod Choudhari[3]

[1]PG (Scho), [2](Asst. Prof.), [3](Prof. & HOD) Dept. of Rachana Sharir, Shri Ayurveda Mahavidhyalaya, Nagpur.

Article Received on
23 Jan. 2024,

Revised on 13 Feb. 2024,
Accepted on 04 March 2024

DOI: 10.20959/wjpr20246-31637

***Corresponding Author**
Dr. Shraddha Dube
PG (Scho), Dept. of Rachana Sharir, Shri Ayurveda Mahavidhyalaya, Nagpur.

ABSTRACT

Introduction: Osteoporosis or porous bone is a worldwide problem characterized by low bone mass and structural detoriation of bone tissue, leading to bone fragility and an increased risk of fracture. After the menopause this osteoporotic changes occurs fastly. Though Menopause is natural & inevitable event as a part of normal process of aging, it is becoming a major health issue in recent years. In the era of information and technology woman have dynamic and multidimensional attit ude but Indian woman still has a tendency to ignore her health issue. Low bone mineral density (BMD) was reported with the advancement of age and the menopausal status. Millets are small-seeded plant species well known as the powerhouse in detail under Shuk Dhanya Varga. Several millet grains have a very High Nutritive Value and among them Finger millet (Eleusine corcana)- Ragi in Hindi is Rich source of calcium, protein and other minerals.[4] **Materials & Methods:** All literature reviewed and compiled from Ayurvedic classic texts (Samhitas, nighantus), text books, magazines, journals, research papers, data available on internet for this review article. **Result:** Ragi is important millet grown extensively in various regions of India and has the highest amount of Calcium**.** For Prevention of the menopausal osteoporosis Consumption of Ragi as a diet Product will be beneficial for Post-Menopausal Woman of nutrition. They are of much significance as they can be grown in extreme conditions like low soil fertility, low moisture, hot environmental conditions and drough- affected land. Ayurveda explains millets.

KEYWORDS: Millets, Shukdhanya, Osteoporosis, Menopause, Finger Millet- Ragi.

INTRODUCTION

Osteoporosis is characterized by a low bone mass with micro-architectural deterioration of bone tissue resulting in a reduction in bone strength and increased susceptibility to fracture. It is predicted that Osteoporosis-related fracture occur in one out of every two women & one in every eight men over 50 years of age. Fracture leads to permanent disability or death. Most of the fractures treated with surgical intervention caused longer hospital stay and thus increased the economic burden over the developing and underdeveloped nations hence particular attention should be paid to osteoporosis. Due to the latent nature of the disease, it is difficult to recognize symptoms until a fracture occurs. In Ayurveda, this bone loss is called *Asthikshaya*. It is caused by nutrient deficiency caused by malnutrition and *Vata* dosha imbalance. Instead of taking medications, foods fortified with essential nutrients can help improve osteoporosis. Millet is a small grass seed. These are small-seeded annual grasses, many of which are adapted to tropical and dry climates and are characterized by ability to survive in less fertile soils. Millets include sorghum (*Jowar*), pearl millet (*Bajra*), finger millet (*Ragi*), foxtail millet (*Kakum*), proso millet (*Chenak*), little millet (*Kutki*), kodo millet (*Kodon*), barnyard millet (*Sanwa*), and brown top millet.*Ragi* or finger millet is a good source of natural calcium. It helps in strengthening bones and also helps to balance *Vata*. This reduces the risk of Osteoporosis. The current article is aimed to know more detailed information, absorption and mode of action.

MATERIALS AND METHODS

Ancient Ayurvedic texts such as *Charaka*, *Sushruta*, *Astanga Hridaya* mentioned about millets. *Rajnighantu*, *Kaiyyadev Nighantu* and Acharya Priyavat Sharma mentioned more detail information about Ragi. Modern literature and modern research articles, textbooks, magazines, journals, research papers, data available on the internet, online databases, PubMed, PubMed Central, and Google Scholar were searched. All literature was reviewed and compiled.

Reference in ayurvedic text

Raj nighantu

रागी तु लाञ्छनः स्याद्बहुदलकणिशश्च गुच्छकणिशश्च ॥

तिक्तो मधुरकषायः शीतः पित्तास्रनाशनो बलदः ।। (शाल्यादिवर्ग्-१३६ -१३७)

In Raj Nighantu it also known by the names *Lanchan*, *Bahudalakanisa* having properties such as *Tikta* (~bitter), *Madhura* (~sweet) and *Kashaya* (~Astringent) taste, *Sheeta* (~cold) *Veerya* and pacifies mainly *Pitta* and *Rakta*. It provides strength to the body.

Kaiyyadev nighantu

In Kaiyyadev Nighntu Ragi is Describe As ***NARTAK*** having *Pittanashak* And *Shitvirya* properties.

Paryay- Malinjak, Nrittyakund, Nartaak, Nartkundak.

Prof. priyavat sharma

They discribe it as a Madhulika and it has Madhurarasa, Sheeta virya, snighdha guna, laghu, bhruhan and Pathya. Other properties include Brihana, Triptikarak, Balakarak, and Raktapittashamak. The synonyms of Finger millet include Ragi, African, bird's foot, rapoko, Hunsa, wimbi, bulo, telebun, koracan, kurakkan.

Introduction

Family- (Gramini - Gramineae).

Name – Latin-Eleusine Coracana, Sanskrit- Madhuli, Ragika, Nartak, Hindi- Mandua, Mandal, Marathi – Nachani, English- Finger Millet.

Nature- This Rainy Season plant is 2-4 feet high. The stem is flat, clustered in which somewhat curved inwards, 5-6 inches long

Granules- Circular or Somewhat flat, smooth, wrinkled, Bloody, brown to white in colour.

Place of origin- It is cultivated especially in south India. Apart from India, it is staple food of man tribes in East Africa, Ethiopia and Somaliland.

It is Sown in May-July and The Crop is Ready in August- November. It can be Stored for 50 yrs.

From the point of view of chemical composition and nutrition, its place is almost equal to wheat. It contains moisture 13.1, protein 7.1, fat- 1.3, carbohydrate-76.3, mineral matters 22, calcium 033, phosphorus 027 % and iron is 54 mg per 100 g. contains vitamin A and B. It contains more iodine than all Grains. There is also Sulphur and Jasad.

Properties-Mandua is short, astringent-bitter-sweet, cold, satiating, *Tridosha Shamak* and specially *Pitta Dosha Shamak.*

Uses- Dietary- Roti and sattuis made from its floor.

Malt is prepared from the sprouted grains. At some special places they are also used in making liquor.

Ragi

English- Finger millet

Marathi- Nachani

Finger millet

Contains about 5-8 % protein

65 -75 % carbohydrates

15-20% Dietary Fiber and

2.5-3.5% minerals

Of all the cereals and Millets, finger millet has the highest amount of Calcium (344mg%) and Potassium(408mg%).

Why use finger millet as a model for calcium?

Finger millet possesses all the quantitative and qualitative traits to serve as a model for Ca biofortification. It stands out as the richest source of Ca among all the cereals (Table 1). It has three times more Ca than milk and 10-fold higher Ca than brown rice, wheat or maize. Besides Ca, finger millet is also very rich source of iron, amino acids like methionine, slowly digestible starch and phytochemicals like polyphenols. It is a gluten-free, low fat cereal which is non-allergic and easily digestible. For these characteristics, it is often termed as a "super cereal". Therefore, integration of a naturally Ca-rich crop like finger millet in global biofortification programs can be a good starting point to alleviate Ca malnutrition. Given that women share a significantly higher proportion of osteoporotic morbidity. Regular consumption of finger millet during Post Menopausal age can provide significant benefits to Woman health. Another advantage of Ca-enriched finger millet over expensive commercially fortified foods is its affordability to these malnourished areas. For low income households which mostly subsist on starchy and bulky foods like rice and cassava for their calorie requirements. Finger millet ensures a pragmatic solution that no family member (Especially Women and Children) suffers from Ca deficiency.

TABLE 1 | Calcium content of various cereals.

Cereal	Calcium content (mg/100 g edible portion)	References
MILLETS		
Finger millet (*Eleusine coracana* L.)	344	Shobana et al., 2013
Teff (*Eragrostis teff*), mixed	78.8–147	Baye, 2014
Fonio (*Digitaria exilis*)	44	National Research Council, 1996
Pearl millet (*Pennisetum glaucum*)	42	Shobana et al., 2013
Foxtail millet (*Setaria italica*)	31	Shobana et al., 2013
Kodo millet (*Paspalum scrobiculatum*)	27	Shobana et al., 2013
Barnyard millet (*Echinochloa crus-galli*)	20	Shobana et al., 2013
Little millet (*Panicum sumatrense*)	17	Shobana et al., 2013
Proso millet (*Panicum miliaceum*)	14	Shobana et al., 2013

Finger millet belongs to the family Poaceae and is more commonly known as ragi or madua in India rapoko in South Africa and dagusa in Ethiopia. Finger millet has been perceived as a potential "super cereal" by the United States National Academies being one of the most nutritious among all-major cereals. Finger millet is enriched in the essential amino acids like lysin and provides amino acid methionine, which is deficient in other starch cereals. Finger millet is used in cakes, pudding, and porridge as it has excellent malting properties and widely used for weaning food. It is the richest source of Calcium among cereals with up to 10-fold higher Calcium content than brown rice, wheat or maize and three times than that of milk. As finger millet is often grown and consumed primarily in developing countries by small-hold farmers with limited agronomic resources, it is often referred to as a "crop for the poor" or a "famine food" Finger millet has the highest productivity of (1640kg/ha) among the millets in India, and is frequently grown both dry and irrigated on lands where moisture is insufficient for rice. About 60% of finger millet is produced by the state of Karnataka which is about 34% of global production. Finger millet is comparatively resistant to storage insect pests which makes the crop an important source of food during famine as the grains can be stored as long as 50 years without much loss due to deterioration.

RESULTS

Ragi is rich in calcium (0.34%) which helps in strengthening bones. It is an excellent source of natural calcium for post menopausal womans. It is thirty times more than that of rice and wheat (Srivastava and Sharma 2012). Ragi consumption helps in development of bones in

growing children and maintenance of bone health in adults. Ragi keeps disease such as osteoporosis at bay and could reduce rick of Also it is rich source of dietary fibre (18%), phytates (0.48%), protein (6%-13%), minerals (2.5%-3.5%) and phenolics (0.3%-3%). Also, it has good amounts of thiamine, riboflavin, iron, methionine, isoleucine, leucine, phenylalanine and other essential amino acids. The abundance of these phytochemicals enhances the nutraceutical potential of finger millet, making it a powerhouse of health benefitting nutrients. As modern medicine contain inorganic calcium compounds such as calcium carbonate, calcium citrate etc which may be of modest bioavailability and can have undesirable effects such as kidney stone formation, constipation, etc and as the high levels of calcium in finger millet and the positive results in the existing studies hold a promise for health benefits associated with finger millet integration into more diets and programs.

DISCUSSION

Osteoporosis is a global health problem that currently affects more than 200 million people worldwide. Population studies in India show that the prevalence of osteoporosis is 3% in men and 8% in women by ICMR report. It is now widely accepted that the entire world is facing numerous health problems due to fiber-free foods. It is also clear to patients that all diseases of civilization can be completely cured by consuming millet and avoiding refined products. To prevent the risk of osteoporosis disease, a balanced diet is necessary. There is a growing trend in research focusing on the use of alternative grains such as ragi (millet), which have the potential to be beneficial to health and prevent the increase in calcium deficiency in people. Millet deserves attention because it is an economical millet with a higher content of fiber, numerous microelements and phytonutrients, and its harmful effects are practically not reported**.**

REFERENCES

1. NIH Consensus Development Panel on Osteoporosis Prevention, Diagnosis, and Therapy. Osteoporosis prevention, diagnosis, and therapy. *JAMA*, 2001; 285: 785–95. [PubMed] [Google Scholar]
2. Lerner UH. Bone remodeling in post-menopausal osteoporosis. J Dent Res, 2006; 85(7): 584-95. doi: 10.1177/154405910608500703. PMID: 16798857.
3. Rao D.B., Malleshi N.G., Annor G.A., Patil J.V. *Millets Value Chain for Nutritional Security: A Replicable Success Model from India.* Indian Institute of Millets Research

(IIMR); Hyderabad, India. Nutritional and health benefits of millets, 2017; 112. [Google Scholar]

4. Nirgude M., Babu B. K., Shambhavi Y., Singh U. M., Upadhyaya H. D., Kumar A. Development and molecular characterization of genic molecular markers for grain protein and calcium content in finger millet (Eleusine coracana (L.) Gaertn.) Molecular Biology Reports, 2014; 41(3): 1189–1200. doi: 10.1007/s11033-013-2825-7. - DOI - PubMed
5. Dr. Sushama Warhade1, Dr. Pratibha Atram2, Dr. Nirmala Sawarkar Finger Millet (Ragi): A Nutritional Boon for Osteoporosis, 2023; 11: VII. Available at www.ijraset.com
6. Aruna Datta: Sarvanga Sundara Commentary on Astanga Hrdaya Sutrasthana, Ed. A.M. Kunte, Chaukhamba, 1982; 11-19.
7. Chakrapani Datta, commentator, the Ayurveda dipika commentary, Charaka Samhita Sutra sthana, of Agnivesha elaborated by Charaka and Dridhabala, Edited by Vd.Yadavaji Trikamaji Acharya, Edition reprint2009, Chaukhambha Surbharati Prakashana, Varanasi, 2009; 13-17.
8. Shobana, S., Krishnaswamy, K., Sudha, V., Malleshi, N. G., Anjana, R. M., Palaniappan, L., et al. Finger Millet (Ragi, Eleusine coracana L.): a review of its nutritional properties, processing, and plausible health benefits. Adv. Food Nutr. Res, 2013; 69: 1–39. doi: 10.1016/B978-0-12-410540-9.00001-6
9. Prof. P.V. Sharma Raj Nighantu, Shalyadi varga Varanasi, Krishnadas Academy, 2003; 3, 555: 136-137.
10. Prof. P.V. Sharma Dravyaguna Vidnyan Varanasi Choukhamba Bharati Academy, 2011; 3, 2: 165-166.
11. Weaver C. M., Proulx W. R., Heaney R. Choices for achieving adequate dietary calcium with a vegetarian diet. American Journal of Clinical Nutrition, 1999; 70(3): 543S–548S.
12. Shobana S., Krishnaswamy K., Sudha V., et al. Finger millet (Ragi, Eleusine coracana L.): a review of its nutritional properties, processing, and plausible health benefits. Advances in Food & Nutrition Research, 2013; 69: 1–39.
13. ICMR annual report. Assessment of prevalence of osteoporosis in adult population in India Multi centric project, 2007.
14. www.ayurwiki.org
15. www.muditainstitute.com et supplement improved the calcium level and Bone Mineral Density
16. http://www.natural healthcure.org/ food/healthy-benefits-of-cereals.html.

17. Sridevi A, Ragi V. Management of osteoporosis in women - A prevalence and interventional study. IAIM, 2016; 3(4): 140-145.
18. Seetha Anitha, et al. Calcium from Finger Millet—A Systematic Review and Meta-Analysis on Calcium Retention, Bone Resorption, and In Vitro Bioavailability, Sustainability.
19. Manavi Rastogi, et al. Effect of Ragi (Eleusione coracana) for the development of value added products and their nutritional implication, Asian journa.
20. Parikh, S. J., and Yanovski, J. A. Calcium intake and adiposity. Am. J. Clin. Nutr, 2003; 77: 281–287.
21. Patil, H. E., Patel, J. V., Vavdiya, P. A., Naghera, Y. V., and Intwala, C. G. A high yielding white colored finger millet variety GNN-7 for cultivation in south and middle Gujarat. Int. J. Trop. Agri, 2016; 34: 1407–1411.
22. Platel, K., Eipeson, S. W., and Srinivasan, K. Bioaccessible mineral content of malted finger millet (Eleusine coracana), wheat (Triticum aestivum), and barley (Hordeum vulgare). J. Agric. Food Chem, 2010; 58: 8100–8103. doi: 10.1021/jf100846e
23. Rachic, K. O., and Peters, L. R. V. The Eleusines: A Review of the World Literature. Manual. Hyderabad: International Crops Research Institute for the Semi-Arid Tropics, 1977.
24. Ramachandra, G., Virupaksha, T. K., and Shadaksharaswamy, M. Relationship between tannin levels and in vitro protein digestibility in finger millet (Eleusine coracana Gaertn.) J. Agric. Food Chem, 1977; 25: 1101–1104. doi: 10.1021/jf60213a046
25. Ramakrishnan, K., and Bhuvaneswari, G. Effect of inoculation of am fungi and beneficial microorganisms on growth and nutrient uptake of Eleusine coracana (L.) Gaertn. (Finger millet). Int. Lett. Nat. Sci, 2014; 13: 59–69. doi: 10. 18052/www.scipress.com/ILNS.13.59