IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 2, September 2025
Impact Factor: 7.67

A Review on Pharmacology of Finger Millet

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Abstract: *Finger millet (Eleusine coracans) is a traditional cereal grain widely consumed across regions in Africa and Asia due to its high nutritional value. In recent years, its pharmacological potential has garnered significant attention. This review aims to consolidate existing k on the pharmacological properties of finger millet, highlighting its bioactive components, therapeutic effects, and underlying mechanisms. Rich in polyphenols, flavonoids, dietary fibre and essential minerals such as calcium and iron, finger millet exhibits a wide array of biological activities including antioxidant, anti-inflammatory, antidiabetic, antimicrobial, and bone health- promoting effects. These benefits are primarily attributed to its high content of bioactive compounds, which exhibit free radical scavenging, enzyme inhibitory, and gut microbiota modulation properties.*

Additionally, finger millet has been shown to support glycaemic control, improve lipid profiles, and potentially contribute to bone mineralization due to its calcium content. However, while in vitro and animal studies provide promising results, clinical evidence remains limited. The processing of finger millet (e.g., germination, fermentation) enhances the bioavailability of its bioactive compounds, further improving its pharmacological efficacy. Despite its therapeutic potential, the wide variability in its phytochemical composition across different varieties and processing methods, as well as gaps in human clinical trials, pose challenges for standardization and dose optimization.

Overall, finger millet represents a functional food with notable pharmacological properties, offering potential as a nutraceutical in managing chronic conditions such as diabetes, cardiovascular diseases, and bone-related disorders. Further clinical research is needed to substantiate its efficacy and safety in human populations.

Keywords: Nutraceutical pharmacological properties antimicrobial, anti-inflammatory, antioxidant, anti-diabetic. Neuroprotective,anti-atherosclerogenic,and anti-tumorigenic properties. Other important terms content of Polyphenol, phenolic acid ,esstinal amino acids, vitamin, Mineral (calcium and iron). Research on finger millet are also terms related to nutraceutical value and potential for functional food and food security.

I. INTRODUCTION

Finger millet, also called ragi, is a strong and healthy grain that doesn't contain gluten. It originally comes from Africa and is now grown in India and other dry areas of Asia and Africa. Ragi is packed with nutrients, including calcium, essential proteins, and minerals, making it a very important food for people living in tough conditions. The plant has small, finger-like seed heads, and its grains are tiny, hard, and last a long time because they resist pests and mold,
finger millet, also known as Eleusine coracana, is a highly nutritious and drought-resistant cereal grain widely grown in parts of Africa and Asia. It is rich in calcium, iron, and dietary substance, making it an excellent choice for improving bone health, digestion, and overall nutrition. Known for its small, round, reddish-brown seeds, finger millet is often used to make flour for baking, porridge, and traditional dishes like ragi ludo in India. Its resilience to harsh climates makes it an important crop in regions prone to dry conditions, providing food security and supporting sustainable farming practices.

DOI: 10.48175/IJARSCT-29008

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Fig no.1

Historical aspects:

Finger millet, or Ragi, originated in the East African highlands around 5,000 years ago, with its domestication occurring between 3000 BC and 500 AD. Ancient crop: Finger millet is one of the oldest cultivated cereals in the world. It is believed to have been first grown in East Africa (especially Ethiopia and Uganda) thousands of years ago. Geographic Origin: Finger millet is believed to have originated in East Africa, particularly in the Ethiopian Highlands, where it was first domesticated around 4,000–5,000 years ago. Over time, it spread to other parts of Africa, India, and Southeast Asia.

Today, it is widely grown in tropical and subtropical regions around the world. Spread to India: From Africa, it spread to India around 3,000 years ago. India became one of the main places where finger millet was widely grown and used.

Spread to India and Asia: It is thought that finger millet was introduced to the Indian subcontinent around 2,000 to 3,000 years ago. The crop is now a staple food in many parts of India, particularly in states like Karnataka, Tamil Nadu, and Odisha. Traditional food: For centuries, finger millet has been a staple food in South India and parts of Africa. People valued it because it grows well in poor soils, survives drought, and stores for a long time without spoiling.

Nutritional Value: Finger millet is rich in essential nutrients like calcium, iron, and fibre are the major origin of complex carbohydrates. It has a low sugar response index, making it suitable for people with diabetes. Historically, it was a food of choice for people living in arid regions because of its nutritional benefits and its ability to grow in marginal field.

Cultural role: In villages, ragi has been linked with local traditions and festivals. It was also considered food for farmers and workers because it gives long-lasting energy.

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Fig no.2

Pharmacology:

Pharmacokinetics of Finger Millet:

Pharmacokinetics studies on finger millet are limited, but available research focuses on the bioavailability of its bioactive compounds like polyphenol. Finger millet, also known as ragi, is a nutritious grain commonly consumed in various parts of the world. When we talk about its pharmacokinetics, we're referring to how the body absorbs, distributes, metabolizes, and excretes the compounds from finger millet. Since finger millet is typically consumed as food rather than a pharmaceutical drug, its pharmacokinetics are generally related to how the body processes nutrients, especially important ones like minerals, calcium, and antioxidants. Here's a simple breakdown of carbohydrates. Finger millet contains beneficial phytochemicals such as flavonoids, phenolic acids, and tannins that exhibit antioxidant and anti-inflammatory properties.1- Absorption: Digestion starts in the stomach where finger millet is broken down. It contains carbohydrates, proteins and get absorbed in the intestines. The nutrients from finger millet, especially minerals like calcium and iron, are absorbed into the bloodstream.

2-Distribution: Once absorbed, the nutrients from finger millet (such as amino acids, minerals, and vitamins) travel through the bloodstream to different parts of the body. For example, calcium from finger millet may go to the bones, helping in strengthening them, while the antioxidants might circulate to fight oxidative stress.3- Metabolism: The body processes the nutrients finger millet in the liver. For instance, carbohydrates are converted into glucose for energy. Proteins from the millet are broken down into amino acids and used to repair muscles and tissues.

4-Excretion: The body eliminates waste through urine and faeces. Excess minerals or unabsorbed components like fibre are excreted.

Factors Influencing Pharmacokinetics

Processing: Fermentation significantly reduces anti-nutrient factors like tannins and phytates, potentially increasing the bioavailability of other nutrients.

Pharmacodynamics of Finger Millet :

Finger millet has a variety of positive effects on the body, thanks to its unique combination of nutrients. It can help control blood sugar, reduce inflammation, improve
digestion, and support bone health, all of which contribute to its potential pharmacodynamic

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The Key Pharmacodynamic Effects of Finger Millet:

1. Blood Sugar Control: Finger millet has a medium glycemic index. It has starch (resistant starch) that is not digested quickly in the small intestine. Instead, it is broken down by good gut bacteria to make helpful substances (SCFAs). This slows down the rise of blood sugar after meals and helps people with diabetes.
2. Bone Strength: Finger millet is very rich in calcium, much more than most other grains. This makes it good for strong bones and for preventing bone problems like osteoporosis.
3. Prevents Anaemia: Because its plenty iron, finger millet helps increase haemoglobin and prevent anaemia.
4. Protects Cells: The seed coat (outer layer) of finger millet has polyphenols, which are natural antioxidants. They protect the body's cells from damage.
5. Supports Digestion: The resistant starch in finger millet also works as a prebiotic, feeding good bacteria in the gut and keeping the digestive system healthy.
6. Bone and Healing Benefits: Some natural compounds in finger millet may help prevent osteoporosis and also support wound healing by boosting growth and antioxidant activity.
7. Heart Health: Finger millet can help lower cholesterol, which is good for the heart.

Clinical implications:

- Controls blood sugar: Helps keep sugar levels steady, useful for people with diabetes.
- Good for the heart: Supports heart health.
- Helps in anaemia: Its rich in iron, it helps the body recover from low haemoglobin.
- Strong bones: High in calcium, good for bones and teeth.
- Anti-aging C disease protection: Has antioxidants that slow aging and protect against long-term diseases.
- Gluten-free C easy to digest: Safe for people with gluten problems, gentle on the stomach.
- Good for all ages: Helpful for children, pregnant women, and older people.
- Supports mental health: Some studies show it may reduce stress and improve brain health

Limitations of Finger Millet use:

- Health limits: Eating too much can sometimes cause problems like kidney stones (because of high calcium) and thyroid issues (because of some natural chemicals in it). It may also cause bloating if eaten in excess because of its high fiber.
- Nutrient limits: Finger millet has phytic acid, which can reduce the absorption of minerals like iron and zinc.
- Farming limits: The crop does not always grow well because it can be affected by drought, pests, diseases, and certain soil types. This leads to lower harvests and makes it less used compared to other crops.

Action of Finger millet in human:

Finger millet (ragi) is good for the body because it has:

- Calcium and iron – which make bones strong and help prevent anemia (lack of blood).
- Fiber – which keeps digestion smooth and helps in controlling weight.
- Antioxidants – which protect the body from damage and lower the risk of diseases like diabetes and heart problems.
- B vitamins – which help the brain work well.
- Amino acids – which help the body build proteins.

Psychological Effects:

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Finger millet (ragi) helps mental health by improving mood, memory, and thinking. It can reduce stress, anxiety, and depression. This is because it contains nutrients like tryptophan, antioxidants, magnesium, and complex carbs. These help make serotonin (the "happy chemical"), lower cell damage, keep blood sugar steady, and support the gut-brain connection.

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