

**APPLICATIONS OF MILLETS IN THE FIELD OF HEALTH AND NUTRITION****Bhumika Chhipani, Saurabh Sharma, Khushboo Gupta, Sandip Prasad Tiwari\*****Faculty of Pharmacy, Kalinga University, Naya Raipur, Chhattisgarh India (492101)**\*Corresponding Author's E mail: [sandip.tiwari@kalingauniversity.ac.in](mailto:sandip.tiwari@kalingauniversity.ac.in)

Received 14 June. 2024; Revised 16 June. 2024; Accepted 22 June. 2024, Available online 10 July. 2024



Cite this article as: Chhipani B, Yadav R, Gupta K and Tiwari SP. Applications of millets in the field of health and nutrition. Asian Journal of Pharmaceutical Education and Research. 2024; 13(3): 144-153.

<https://dx.doi.org/10.38164/AJPER/13.3.2024.144-153>

**ABSTRACT**

The available cultivable plant-based food resources in developing tropical countries are inadequate to supply proteins for both humans and animals. Such limitations of available plant food sources are due to the shrinking of agricultural land, rapid urbanization, climate change, and tough competition between food and feed industries for existing food and feed crops. However, the cheapest food materials are those that are derived from plant sources which although they occur in abundance in nature, are still underutilized. At this juncture, identification, evaluation, and introduction of under-planted millet crops, including crops of tribal utility which are generally rich in protein is one of the long-term viable solutions for a sustainable supply of food and feed materials. In view of the above, the present review endeavors to highlight the nutritional and functional potential of underexploited millet crops.

**Keywords:** Poaceae grass family, Eleusine coracana, Pearl millet, Pennisetum glaucum.

**INTRODUCTION**

One of the earliest crops to be farmed, millets are grains belonging to the Poaceae grass family. The two main millets meant for food and feed are generally recognized as finger millet (*Eleusine coracana*) and pearl millet (*Pennisetum glaucum*). Finger millet is supposed to have evolved in the sub-humid uplands of East Africa, while pearl millet is thought to have originated in sub-Saharan Africa. The majority of millet produced and traded globally is handled by the two. Pearl and finger millets have been the focus of the majority of current agricultural research projects and initiatives aimed at developing millets. Millets are highly varied group of minor seeded grasses. They are grown about the world at a larger scale as cereal crop or grains for food and human food. Cereal crops remain those crops that can be easily cultivated, affordable, renewable and regular source of protein consumed around the world to animal based foods consumed for protein. Separately from it,

cereal proteins that are exactly located in special storage vacuoles called protein bodies are important for food, nutrition and pharmaceuticals application<sup>1-4</sup>. These proteins are important component in diets across the world as they possess “staple status” in the human diet. Their surplus production ensures the global food security. Most species generally referred to as millets belongs to the tribe paniceae and family poaceae, but some millets also belong to various other taxa. Among the food and feeder crops generally pearl millet [*Pennisetum glaucum*] and finger millet [*Eleusine coracana*] are considered two major millets. As they are protein rich so they are highly nutritious. They are measured tough crops because they withstand harsh climate factors [unpredictable climate and nutrient depleted soils]. They are also termed as coarse grains because of its rough surface. Example: Bajra , Ragi , Jowar and etc. In terms of growing requirements, they are observed as robust crops as they can tolerate difficult climatic conditions such nutrient-depleted soils and changeable climates<sup>5-7</sup>.



**Fig. 1 Types of millets**

### **Production of Millets**

Total production throughout world contributes to and top millet producers include India:

13.2(43.85%), China: 2.7 (8.97%), Niger:2.1 (6.98%), Nigeria:1.9 (6.31%), Sudan:1.5 (4.98%), Mali:1.5 (4.98%), Senegal: 1 (3.32%), Ethiopia: 1 (3.32%), Burkina Faso:0.7 (2.33%). It is also the main ingredient in Vietnamese sweet snacks called banh da Ke. which contains the layer of smashed mungbean and millet topped with sliced dried coconut meat wrapped in crunchy rice cake. Also it's a speciality of Hanoi. Rapid growth of millets as a grazing crop allows flexibility in its use ,this grains are high in carbohydrates their protein content varying from 6 to 11 percent. They are somewhat strong in taste and are mainly consumed in flatsbreads and porridges of prepared and eaten much like rice<sup>8,9</sup>.

## **TYPES OF MILLETS:**

There are more than 20 different types of millet. Some of the additional common varieties include:

- Pearl (*Pennisetum glaucum*)
- Finger (*Eleusine coracana* )
- Foxtail(*Setaria italica*)
- Proso (*panicum miliaceum*)
- Barnyard (*echinochloa utilis*)

## **Nutritional Benefits**

Nutritional content of each 100 grams of cooked millets contains:

- 3.51g of protein
- 23.7g of carbohydrate
- 1.3g of dietary fiber
- 0.161mg of copper
- 44 milligrams of magnesium
- 100mg of phosphorous
- 0.272mg of manganese

## **Possible Health Benefits**

All the research indicates millet can be useful in the following ways:

1. It helps in digestive system.
2. Supporting the cardiovascular system.
3. Improving mood.
4. Reducing the risk of diabetes.
5. Managing obesity.
6. Reducing Oxidative stress.

7. Keeping your heart in good shape.
8. Battels cancer cells.
9. Gives you stronger bones.
10. Acts as an agent for anti-aging <sup>10-13</sup>



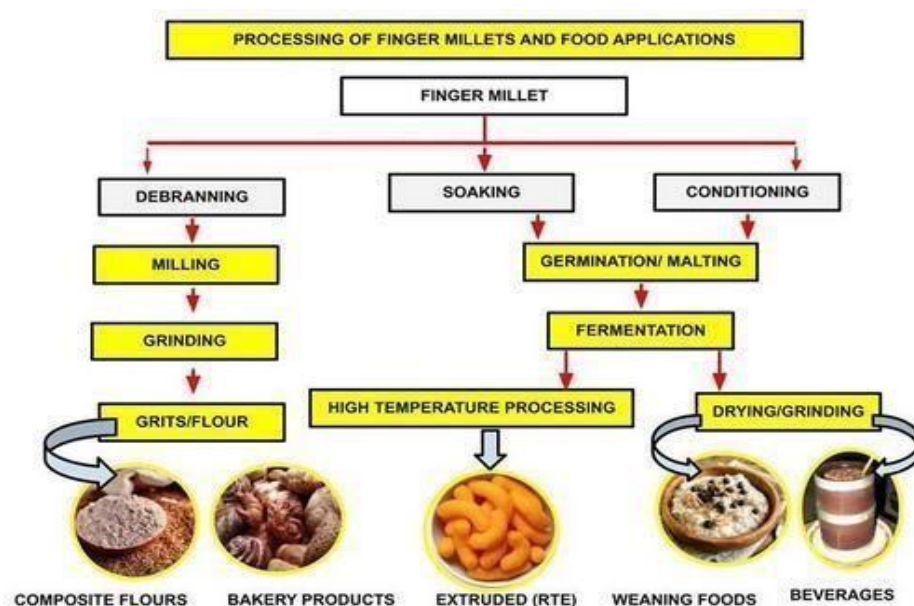
**Fig. 2 Types of Millets**

### **Reducing oxidative stress:**

Oxidative stress may cause various lasting conditions, including neurodegenerative illnesses, arthritis and diabetes. High-fat nourishment is also a risk factor for the growth of dementia because it raises oxidative stress in the brain. Doctors consider antioxidants significant in reducing oxidative injury. Diets rich in antioxidants may protect from oxidative damage. Millet is good origins of antioxidants, which may benefit support the body's capacity to resist oxidative pressure, a factor in sickness and aging. Consuming antioxidants could decrease the risk of lasting diseases. Source also decided that the eating of millet could alleviate oxidative pressure in the hippocampus and lower the rate of expression of alzheimer's disease.

Other health provision of millets include:

- Suppressing cancer cell development
- Promoting wound curing
- Keeping bone health <sup>14-15</sup>



**FIG.3 Processing of Finger Millets**

## Biochemical Processing Treatments

### 1. Soaking:

Soaking is not careful a processing handling but can be observed as a pre-treatment previously the endprocessing of millet grain. Soaking is an important step in so many treatments, including sprouting, food, extraction, also fermentation. Alternatively, it can also be denoted to as steeping. The process outcomes in the leaching of many soluble molecules, like oligosaccharides, tannic acid, also phytic acid. Soaking enhances distilled water to finger millet grains till the grains are entirely soaked in water also left overnight at an surrounding temperature of 30 to 60°C . Soaking includes submerging solid grains to hot and lukewarm water and then letting it dry in a hot midair oven at 60° for 90 min by the major unbiased of quick, uniform water absorption. Through the soaking process, water is captivated, which enhances heat transmission effectively incapacitated. Also, grain hydration is vital for microbial growth through fermentation to keep the required water motion. After soaking raw millet for 36 h at surrounding temperature, the trypsin inhibitor action decreased from 6.37 to 5.70 TUI/mg <sup>16,17</sup>

### **Milling/Grinding/Decorations**

Milling/grinding is single of the vital preliminary steps in the making of millets, which includes size decrease and the elimination of coarse bran or seed skin. These millets include a large share of husk/bran, which has to be removed by dehusking and debranning before eating. The milling procedure involves organizing, scrubbing, hulling, debranning, and cleaning for additional processing. millet kernels possess a delicate endosperm also an whole seed coat, which make it difficult to coat and cook in the method of grain or grit such as rice or various cereals. Consequently, flour must always be prepared by milling the grain. 10% of water is frequently added during the milling procedure to facilitate the elimination of the hard, rubbery husk. Milling expands the removal of some of antinutrients, thereby cultivating the bioavailability of iron. Later milling, a important decrease of polyphenols by 74.7%<sup>18,19</sup>.

### **Pharmacological Significance**

Numerous studies have established the value and role of phenolic compounds, which are originate in high concentrations in the seed skin of millets, as bioactive substances. These include anticarcinogenic, anti-inflammatory, antiviral, and neuroprotective properties against deadly conditions such as cancer, cardiovascular disease, diabetes, high blood pressure, cholesterol, and neurodegenerative illnesses. Fine-grained collagen glycation inhibition, cross-linking, nephritis, diabetes, wound healing, oxidation, enzyme inhibition, osteoporosis, and microbial action are all said to be counteracted by FM phenolics. Nutraceuticals from millets may also have health benefits. These include a number of advantages like better digestive system health, lower cholesterol, preventing heart disease, diabetes, and cancer, as well as greater energy and improved. When pearl millet was substituted for maize in an early study on growing and nursing goats, the amount of feed consumed and the amount of milk produced remained unchanged. However, they observed a decrease in the feed to gain ratio and daily growth rate when pearl millet was utilized exclusively in place of maize. They concluded that while pearl millet would be a suitable energy feed substitute for older goats, younger goats might not benefit from it. It is significant to remember that much of the research on millet as a substitute for maize was conducted. Millet grain is also thought to be a beneficial alternative to maize for large animals. A study conducted by shown that pearl millet grain<sup>20,21</sup>.

## **Applications of millets**

Due to the millet's African origins, our African ancestors used millets to manufacture a variety of derivative goods. Several generations have been exposed to the byproducts. Millet has been used to make alcoholic and non-alcoholic beverages. Regretfully, research on their makeup and possible health advantages for humans is still lacking. Making traditional African beverages requires a amount of steps, including soaking, drying, and fermentation. African beer is sour, less carbonated, and frequently unpolished than Western beer, according to Haggblade and Holzapfel. There are several drinks from Africa; one of them is togwa, a fermented beer made with lactic acid. Four different forms of food are made from finger millet: ugali, uji, vtogwa, and pombe. Finger millet is observed as the primary component of an alcoholic drink known as pombe in various regions of Tanzania. Finger millets are used to make three different types of pombe: kimpumu, komoni, and kiambule. The people think that the pombe's robust flavor comes since finger millet that has germinated<sup>22,23</sup>.

## **A state of food safety is one Issues with food security in developing nations**

in which individuals have both financial and physical contact to wholesome food that satisfies their nutritional needs. According to, the problems related with food security are frequently limited to the availability of agricultural products like animals. But it's thought that the problems go beyond simply stockpiling more of something. Among the many limitations mentioned by are urbanization and accessibility. In addition, some of the details that lead to food insecurity include institutional failures and the structure and procedures that govern economies and communities. To overcome these intricate obstacles, multisectoral strategies and preparation are needed. Pangaribowo state that combining food insecurity indicators with the socioeconomic and environmental data that are available for a specific entity is the best approach to address the problems related to food and nutrition security. Notwithstanding the difficulties facing emerging nations' food security, underutilized, locally grown grains like millet have a valuable role to play. Some of these difficulties cannot be solved with the traditional grain crops alone. When considering circumstances like the present, unparalleled COVID-19 pandemic, the production of small crops like millet could exacerbate poverty among the impoverished population<sup>24-26</sup>.

## CONCLUSION

The reviewed research indicates that finger and pearl millets can be used as a substitute energy source in chicken diets. Comparable to, or occasionally higher than, the nutrients contained in conventional cereals like rice, wheat, and maize, it offers competitive nutrition. Moreover, the occurrence of nutraceuticals in millets adds to their significance in terms of health profits, especially for human health. Up to 100% of millets can be further to broiler meals as a supplement without negatively affecting the hens' performance. When millet was introduced to the diets of ruminant animals, there was a noticeable improvement in their performance indicators. Because of this inclusion, feed prices for animal production may eventually decline, lowering the value of livestock goods for customers who trust on the

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