# Quality Assessment of Local market millets :A Physiological and Microbiological Approach

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## 1. Introduction

Millet is a major drought-resistant crop that serves as a nutrient rich food staple in Africa and Asia. In addition, millet contains an abundance of bioactive compounds with antioxidant activity. The intake of antioxidants through the diet is essential for improving human health. Millets are the most commonly consumed food items in India.millets areone major cereal grains consumed worldwide.especisally inarid andsemiarid area of Africa and asia (india and china) they are great intrest because of their high nutritive value and agro-industrial importance (saleh et al.,2013, Zhu et al., 2018 ). They contain a wide range of phenolics which are good sources of natural antioxidants. Studies report that methanolic extracts from red sorghum showed higher antioxidant activity and contain higher polyphenolic levels compared to rice, foxtail millet, prosomillet and barley (Choi, 2007). Bran, a byproduct of milling has antioxidant potential due to phenolic acids such as *p*-coumaric acid and vanillic acids that are concentrated in the bran portion of cereal kernels. Antioxidant activity of five bran extracts exhibited appreciable levels of total phenolics, flavonoids and DPPH radical scavenging activities (Iqbal, et. al., 2007). Processing, such as soaking and roasting, have been shown to influence total phenolic, flavonoid and antioxidant contents in selected dry beans. Raw kodo millet and finger millet have higher DPPH radical scavenging activities. However, cooking of these millets by roasting or boiling reduced their antioxidant activity (Hegde, et. al., 2005).

Millets contain phytic acid, tannin and phenols which can contribute to antioxidant activity, important in health, ageing and metabolic diseases. Pearl millet (*Pennisetum typhoideum*) is the most widely grown type of millet. Nutritionally, pearl millet is superior to major cereals with reference to energy value, high quality proteins, fat and minerals such as calcium, iron, zinc. Besides, it is also a rich source of dietary fiber and micro nutrients (Anu, 2006). While, extensive information is available on proximate composition and mineral accessibility, information on antioxidant activity and its influence on processing in pearl millet is scanty. Research on the effect of processing on retention of bioactive components with potential antioxidant activity is very important. The objective of this investigation was to evaluate the effect of various processing methods (milling, heat treatments and germination respectively) on antioxidant components as well as antioxidant activities of pearl millet extracts. The alcoholic extracts of raw and processed pearl millet and selected varieties will be analyzed for free radical scavenging activity.

The term "phytochemicals" or "plant chemicals" refers to every naturally occurring chemical substance present in plants, which also has a potential for antioxidant activity. Antioxidants play an important role in the body's defense system against reactive oxygen species (ROS), which are the harmful byproducts generated during normal cell aerobic respiration (Ou et al., 2002). In foods, antioxidants prevent undesirable changes in flavor and nutritional quality of a product 9Zielinski, et al., 2016). Several methods have been developed to measure "antioxidant activity". Commonly used assays are reducing power assay (RPA), ferric reducing antioxidant power (FRAP) and 1,1-diphenyl-2-picrylhydrazyl (DPPH) free radical scavenging activity. There are two basic categories of antioxidants, namely, natural and synthetic. Natural antioxidants are phenolic compounds (flavonoids, phenolic acids), nitrogen compounds (alkaloids, chlorophyll derivatives, amino acids, and amines), carotenoids and ascorbic acid. Butylated hydroxyanisole (BHA) and butylated hydroxytoluene (BHT) are commonly used synthetic antioxidants that have been in use since the beginning of this century. Restrictions on the use of these compounds, however, are being imposed because of their carcinogenicity (Velioglu, et al., 1998).

**The main objectives of the plan study are as follows**:

To study the phyto-chemical analysis of Pearl millet (Pennisetumglaucum), finger millet (Eleusinecoracana), foxtail millet (Setariaitalica), kodo millet (Paspalumsetaceum), and barnyard millet (Echinochlosutilis) extract .

## 2. Review of Literature

Millets, which are members of the Poaceae family (Gramineae), are regarded as the first cereal crop cultivated at the dawn of human civilization thousands of years ago (Lu et al., 2005). Pearl millet (Pennisetumglaucum), finger millet (Eleusinecoracana), foxtail millet (Setariaitalica), kodo millet (Paspalumsetaceum), little millet (Panicum sumatrense), barnyard millet (Echinochlosutilis). Millets are gluten-free and resistant to biotic stress conditions by nature (Das and Padmaja, 2016). Pearl millet is a C4 crop (Srivastava et al., 2022) that is able to grow in semiarid and arid regions due to its capacity for adaptive evolution in drought and heat stress (Serba and Yadav, 2016). Red-pigmented finger millet testa is rich in tannin phytochemicals. This provides insect resistance to finger millets. (Chandrashekar and Sathyanarayana, 2006). It possesses anti-diabetic and anti-oxidant properties (Sooriya et al., 2022).

Foxtail millet is an excellent source of the amino acid proline and the alcohol-soluble proteins setarins (Sachdev et al., 2021). Potentially, the antioxidant phenolic compounds mitigate degenerative syndromes such as diabetes and hypertension (Florence and Asna, 2014). It contains antimicrobial phytochemicals, including tannins that prevent food spoilage. Millet species are widespread in tropical regions and have been used for centuries in various folk remedies. Millets are abundant in essential amino acids, micronutrients (carotenoids and tocopherols), vitamins, and minerals (such as magnesium, manganese, and phosphorus). In addition to minerals and vitamins, the edible portion of millet is composed of carbohydrates (60–70%), proteins (7–11%), and fat (1.5–5%). According to the findings of this study, pearl millet, Kodo millet, little millet, Fox tail millet, and finger millet all contain high levels of phytochemical activity. Foxtail millet aqueous extract has antihyperglycemic properties and reduces serum triacylglycerol and C-reactive protein levels. Millets possess phenolic acids, flavonoids, tannins, xylo-oligosaccharides, insoluble fibers, carotenoids, and vitamin E (Shan and Kehong, 2019).

Free radicals are compounds or tiny particles with unpaired electrons in their molecular or atomic orbitals, or simply ROS, which also include a variety of oxygen species, such as hydrogen peroxide, a strong oxidizing functional group produced by cellsduring respiration and cell-mediated immunity. Antioxidants are substances that neutralize free radicals and render them harmless, so that they cause less harm to biological processes. Compared to other cereals, pearl millet has higher levels of calcium, iron, zinc, lipids, and high-quality proteins with a high concentration of threonine and tryptophan and adequate leucine (Balasubramaniam et al., 2012). Foxtail millet, also known as Italian millet (Verma et al., 2014), is an excellent source of protein (12.3 g/100g) and dietary fiber (14 g/100g), while its carbohydrate content (60.9 g/100g) is low. In addition, it is abundant in minerals (3 g per 100 g) and phytochemicals. Foxtail millet is an excellent source of -carotene (126-191 µg/100g, according to Goudar et al., 2011).

Pearl millet (Pennisetumglaucum) is the sixth most important cereal crop in the world and is cultivated by subsistence farmers in the semi-arid regions of sub-Saharan Africa and the Indian subcontinent (Haussmann et al., 2012). It is the primary source of nutrition for 500 million of the world's poorest people, primarily in Asia and Africa. It is the most tolerant cereal crop to a wide range of harsh environmental conditions, including those with high mean temperatures, frequent droughts, and/or poor soil fertility.

Foxtail millet (Setariaitalica, formerly Panicum italicum L.) is the most important species of millet in East Asia and the second most widely planted species of millet worldwide. Among Setaria, Green foxtail, Italian millet, German millet, Chinese millet, and Hungarian millet, it has the longest history of cultivation. Millets have been cultivated in China since roughly the sixth millennium BCE. Dwarf Setaria, foxtail bristle grass, giant setaria, green foxtail, Italian millet, German millet, Chinese millet, and Hungarian millet are alternative names for this species (Krishna Kumari et al., 1997).

Little millet is a cereal species that resembles proso millet in appearance but is smaller. It is an annual herbaceous plant that grows 30 cm to 1 m tall with straight or folded blades. The leaves are linear with occasionally hairy laminae and hairy, membranous ligules. The panicles range in length from 4 to 15 cm and have a 2 to 3.5 mm long awn. The grain is round and smooth, measuring between 1.8 and 1.9mm in length. Asia's temperate regions include the Caucasus, China, and East Asia, while the continent's tropical regions include India, Indochina, and Malaysia. It is resistant to both drought and flooding. It can be grown up to 2000 meters above sea level (Jones et al., 2010).

These crops are hardy and quite resistant to diverse agro-climatic adversities, and they play a significant role in marginal agriculture, which is more prevalent in hilly and semi-arid regions, as an important source of food grain and highly valued fodder. In various regions, these grains are used to make a variety of traditional foods and beverages, and therefore play an important role in the local food culture. Unfortunately, millets have come to be perceived as crops of the poor, which they are, and are therefore to be avoided. Continued neglect accelerates the loss of genetic diversity and traditional knowledge regarding the production, processing, and application of millets. Due to a lack of suitable, higher-yielding varieties, poor seed quality, and inefficient cultivation methods, production is inefficient.

ISSN PRINT 2319 1775 Online 2320 7876
 Journal UGC CARE Listed (Group-I) Volume 11, Issue 11 2022

## 3. Material and Methods

Pearl millet, finger millet, fox tail millet, kodo millet grains were purchased and washed before being sterilized with 0.1 percent Mercuric chloride ($HgCl_2$) and kept at room temperature (25°C).

### 3.1 Extract Preparation:

Pearl millet, finger millet, fox tail millet, kodo millet grains (20g) will be extracted in Double Distilled water solvent, then collected and concentrated in a water bath at 40-50°C. The dry powder will be stored in an airtight container.

### 3.2 Phytochemical analysis:

The presence or absence of several active metabolites will be checked using following conventional chemical test on the aquous extract of Pearl millet, finger millet, fox tail millet, kodo millet grains.

| Component | Method | Material | Observation |
|---|---|---|---|
| **Test for carbohydrate** | Barfoed's test | 1mL filtrateb + 1mL Barfoed's reagent + Heated for 2 min. | A red precipitate means that monosaccharide's are present |
| **Test for reducing sugar** | Benedict's test | 0.5mL filtrateb + 0.5mL Benedict's reagent + Boiled for 2 min. | Reducing sugar is indicated by colours such as green, yellow, and red |
| **Test for alkaloids** | Dragendroff's test | Few mL filtratea + 1-2 mL Dragendorff's reagents | The presence of an alkaloid is indicated by a reddish-brown precipitate |
| **Test for cardiac glyceride** | Cardenolides | Extract + pyridine + Sodium nitroprusside + 20% NaOH | Glyceride will show as a crimson colour that gradually turns brownish yellow |
| **Teat for protein** | Xanthoproteic test | Plant extract + Few drops of conc. Nitric acid. | The presence of protein will be indicated by a yellow-colored solution |
| **Test for phytosterol** | Hesse's response | 5mL aq. extract + 2mL chloroform + 2mL conc. $H_2SO_4$ | Phytosterol will be seen as a pink or red colour in the lowest layer of chloroform. |

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| **Test for tannins** | Tannins ferric chloride test method | Plant extracts +5ml dw +1% dilute | The presence of tannins will be indicated by a brown or greenish colour. |
| **Test for phenol** | Test for Carotenoids | 1gm plant extract + 10mLchloroform, vigorously shaken and filtered. To the filtrate add conc. $H_2O$ | The presence of phenol will be indicated by a blue colour |
| **Test for quinine** | Sulphuric acid test | plant extract + few ml alcohols + a drop of conc. $H_2SO_4$ | The presence of quinone will be shown by the development of a red colour |
| **Test for flavonoids** | Conc. H2SO4 test | Plant extract + conc. $H_2SO_4$ | Flavonoid content is shown by the presence of orange colours |
| **Test for Terpenoids** | **Terpenoids test** | Filtrate+ few drops of conc. $H_2SO_4$ shaken well and allowed to stand. | Golden yellow layer at the bottom will indicate the presence of terpenoids. |
| **Test for Triterpenoids** | Salkowski's test | Filtrate + few drops of conc. $H_2SO_4$ Shaken well and allowed to stand | Terpenoids will be seen as a bottom layer of golden yellow |
| **Test for Saponins** | Saponins test | Foam test 0.5gm plant extract + 2mL water vigorously shaken. | Saponin is detected by persistent foam that lasts for 10 minutes. |

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