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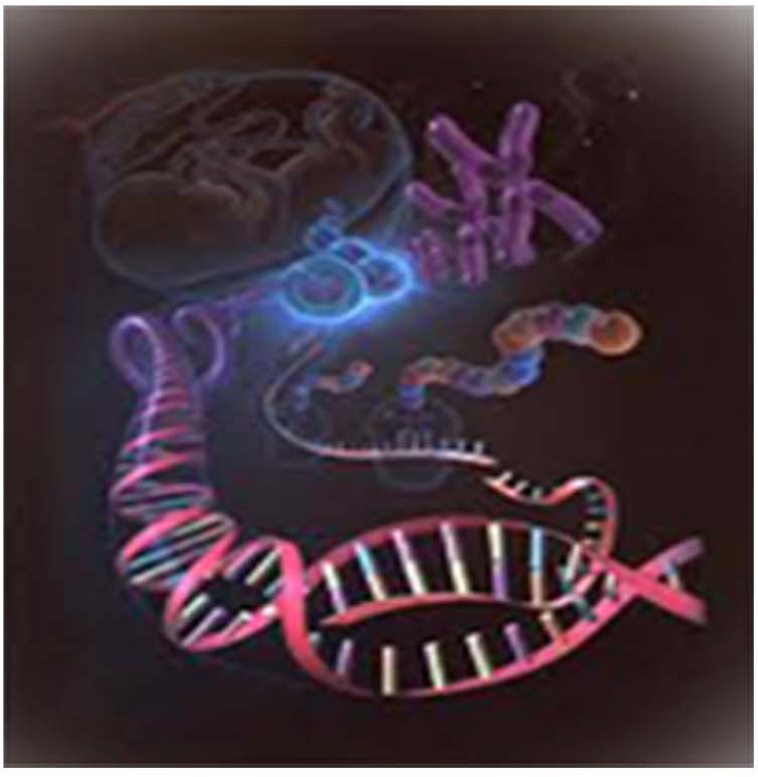

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Research Paper

BIOCHEMICAL, ANTIMICROBIAL AND ORGANOLEPTIC STUDIES ON THE GERMINATION PROFILE OF FINGER MILLET (*ELEUSINE CORACANA*)

Jyoti D Vora[1], Ashwini Ganesh Rane[1]* and Priyanka Jadhav[1]

*Corresponding Author:***Ashwini Ganesh Rane** ✉ *ashwinig_rane@hotmail.com*

Finger millets (or ragi) are cereals and the staple food of the millions residing in the arid and semi-arid tropics of the world. The grains of finger millets, being nutritionally superior to wheat provide carbohydrates, dietary fibers, minerals and vitamins to poorest of the poor where the need is essential. Finger millet can be regarded as a functional food, to be taken as part of the usual diet in order to have beneficial effects that go beyond basic nutritional function, thus helping to reduce the risk of diabetes, obesity, malnutrition, and premature aging. An important factor of the functional food which is required to reduce the risk of chronic illnesses is 'proper intake and antibacterial activity'. Antibacterial is used to treat bacterial infections, Germinated finger millet seeds extract (12 h sample) has a bactericidal antibacterial property against *Escherichia coli* and can be consumed for management of infectious diarrhoea. However prolonged use of certain antibacterial can decrease the number of gut flora, which may have a negative impact on health. Results indicate that potential exists to utilize finger millet as an alternative natural antioxidant and food preservative. Sensory evaluation was carried out to project the organoleptic appeal, which proved that ragi sample was very well accepted.

Keywords: Finger millet, Staple food, Functional food, Organoleptic appeal, *Escherichia coli* Antibacterial, Antioxidant, Sensory evaluation

INTRODUCTION

Finger millet is an annual plant widely grown as a cereal in the semi-arid parts of the world. In India it is cultivated over an area of 2.65 million hectares with total production of about 2.9 million tonnes. The state of Karnataka is a leading producer accounting for 58% of India's finger millet production. Millets, being less expensive compared to cereals and the staple for the poorer sections of population could be the choice for nutritional contents. It is a tufted crop growing to a height of 30-150cm and maturing in 75-160 days. Leaves are narrow, grass-like and capable of producing many tillers and nodal branches. The panicle consists of a group of digitally arranged spikes often referred as 'fingers'. Grain is oblong

[1] Department of Biochemistry & Food Science and Quality Control, Ramnarain Ruia College, Matunga, Mumbai-400019.

to round and oval, reddish brown in color with the grain surface finely corrugated. The crop is of tropical and subtropical climate it can be grown successfully from sea level to an altitude of 1800 meters on hill slopes as well as in plains. Finger millet can be grown on a wide range of soil from poor to very fertile soils. It thrives best in well drained loam to light red loam and sandy loam soils of good fertility.

MATERIALS AND METHODS

The proximate principles of finger millet (*Eleusine coracana*) seeds were analyzed in the present study. Six samples with 0 h, 4 h, 6 h, 8 h, 12 h, 24 h of sprouting were taken and compared with Wheat sample. Fresh samples were taken for proximate principles and mineral analysis daily.

MOISTURE AND MINERAL ANALYSIS

All the finger millet samples were tested for moisture analysis by hot air oven and mineral analysis by ashing method.

TOTAL CARBOHYDRATES BY ANTHRONE METHOD

Total carbohydrates of each sample were analyzed colorimetrically using anthrone reagent: Dissolve 200 mg anthrone in 100 mL of ice cold 95% H_2SO_4. Prepare fresh before use, Standard Glucose stock, 2.5 N HCl. The absorbance was read at 630 nm.

DIETARY FIBRES

Dietary fibers were estimated using Petroleum ether, Alcohol, Sulphuric acid solution:1.25 g concentrated sulphuric acid diluted to 100 mL, Sodium hydroxide solution:1.25 g sodium hydroxide in 100 mL distilled water

VITAMIN C BY USING HARRIS–RAY METHOD

Vitamin C in all the samples were estimated using 2,6 dichlorophenol indophenols blue solution, Glacial acetic acid, Standard Vitamin C solution (0.02 mg/mL), Working Vitamin C solution, Meta phosphoric acid.

PHOSPHORUS BY FISKE-SUBBAROW METHOD

Phosphorus content was estimated using Acid molybdate reagent, 1, 2, 4 aminonaphtho-sulphonic acid (0.25%), Stock standard phosphorus solution, Dissolve 0.351 mg of pure potassium dihydrogen phosphate in water, add 10 mL of NH_2SO_4 and make the volume to 1 L, Working standard phosphorus solution (0.008 mg/mL).

CALCIUM BY ETHYLENEDIAMINE TETRA ACETIC ACID METHOD

Calcium content was estimated using 0.01 M EDTA-0.930 g EDTA in 250 mL distilled water, Ammonia buffer (NH_3:NH_4OH at ph10), Eriochrome black t indicator.

ANTIMICROBIAL ACTIVITY

Sample Preparation

10 g was weighed and grinded in mortar pestle using chilled distilled water. Filter the seeds and measure the volume of chilled distilled water added after extraction. The extract was autoclaved and refrigerated at 4^0C. Extract is then used for determination of Minimum inhibitory concentration.

Minimum Inhibitory Concentration

Minimum Inhibitory Concentration was determined using Stock-Autoclaved non

germinated (0 h) and germinated (12 h) finger millet seeds, Diluent-Sterile Nutrient Broth, Culture-24 h old *E. coli* culture, Incubation time-Incubated at 37^{0}C for 24 h.

Extraction of DNA by Phenol Chloroform Method

Extraction was carried out using Sterile phosphate buffer (pH7.0), Lysis buffer, Proteinase K (20 mg/mL), Absolute ethanol, 70% ethanol, Phenol:Chloroform:Isoamly alcohol (25:24:1),T.E (Tris- EDTA) buffer.

Quantitative Analysis of DNA by Agarose Gel Electrophoresis

Qualitative analysis of DNA using Agarose Gel Electrophoresis was done using Agarose, 1X TBE buffer, 10 mg/mL Ethidium bromide, 6X gel loading dye.

Real Time PCR

Polymerase Chain Reaction was performed using SyBr Green Master Mix, Primers, MilliQ.

RESULTS AND DISCUSSION

The proximate analysis and antimicrobial activity reveal that finger millets were found to contain higher amounts of carbohydrates, dietary fibers, calcium, phosphorus and vitamin C when compared with wheat.

Figure 1: The study showed an increase in Carbohydrates, the major source of biological energy which is obtained through oxidation in the tissue. This information supports that finger millets are healthy sources of carbohydrates for persons with insulin sensitivity or diabetes.

Figures 2 and 3 Finger millet is rich in Calcium and phosphorus which helps in development of bones in growing children and in maintenance of bone health in adults. It may also keep diseases such as osteoporosis at bay and could reduce risk of fracture.

Figure 4 The high fiber in the finger millet may enhance digestibility and also aid the peristaltic movement of the intestinal tract.

Figure 1: Carbohydrate Content

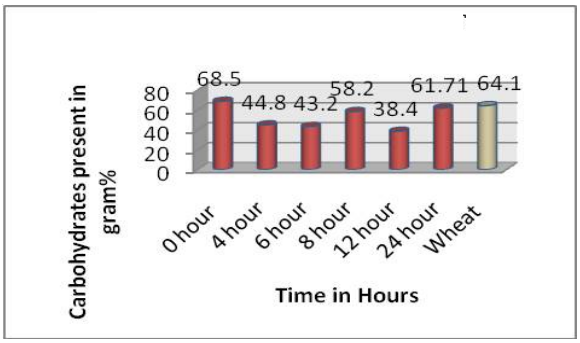


Figure 2: Calcium Content

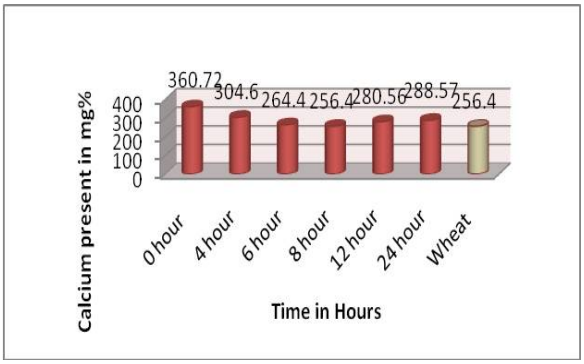


Figure 3: Phosphorous Content

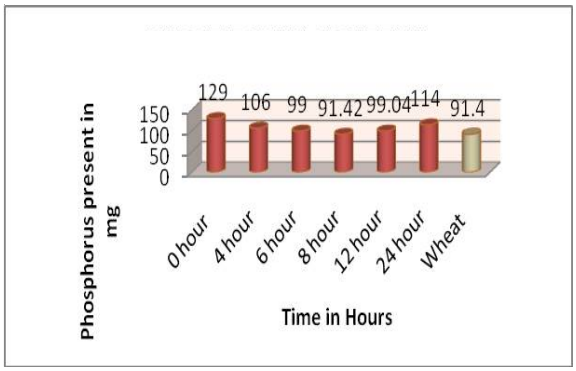


Figure 4: Crude Fiber Content

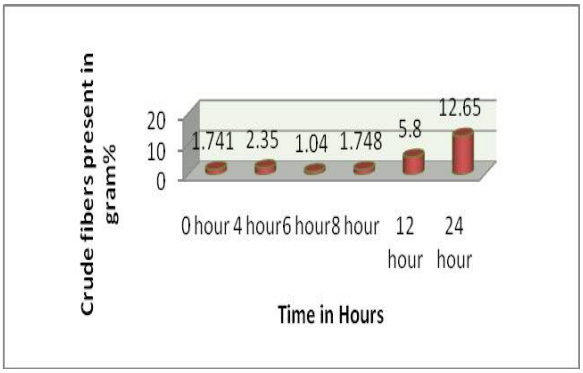
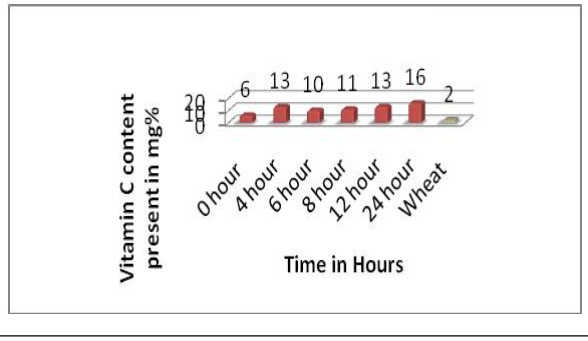


Figure 5 Due to high Vitamin C content that is antioxidants may help fight off free radicals in the body, warding off inflammation, infections.

Figure 5: Vitamin Content



Results: From antimicrobial studies (Tables 1 and 2).

The MIC for non-germinated finger millet (0 h) was found to be 110 mg/mL. The MIC for germinated finger millet (12 h) was found to be 125 mg/mL.

Figure 6 DNA from the MIC sample (germinated and non- germinated finger millet) was extracted using Phenol Chloroform method. The presence of genomic DNA was confirmed by running DNA sample on 1% agarose gel at 50 to 60 V, until the dye front approximately ran 75-80% of the gel. The DNA bands obtained was observed using UV transilluminator.

Table 1: Non-germinated Finger Millet Seeds

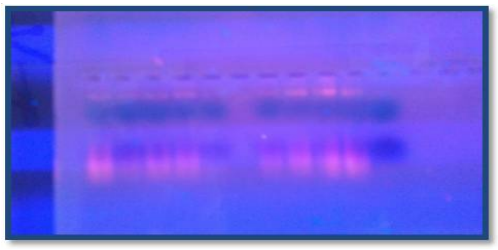
Concentration	Inhibition
22	+++++
44	++++
66	+++
88	++
110	-
Positive Control	+
Negative Control	-
Medium Control	-

Table 2: Germinated Finger Millet Seeds (12h)

Concentration	Inhibition
25	+++++
50	++++
75	+++
100	++
125	-
Positive Control	+
Negative Control	-
Medium Control	-

Note: Abbreviation (+) - Growth, (-) –No Growth

Figure 6: DNA Bands Confirmed by Agarose Gel Electrophoresis



Figures 7, 8, 9, 10 and Table 3 showing Real time PCR results.

Figure 7: Endogenous Control Gene For 0 h sample

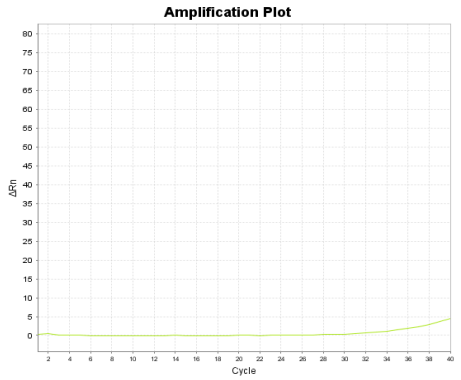


Figure 8: Reference Gene For 0 h Sample

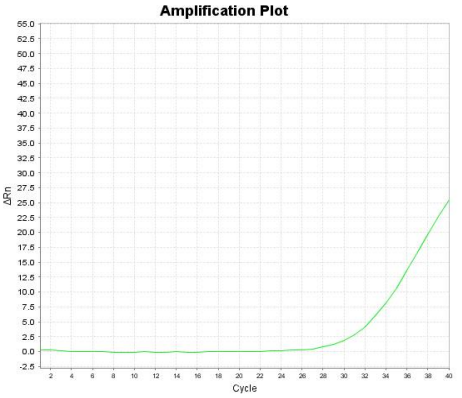


Figure 9: Endogenous Control Gene For 12 h sample

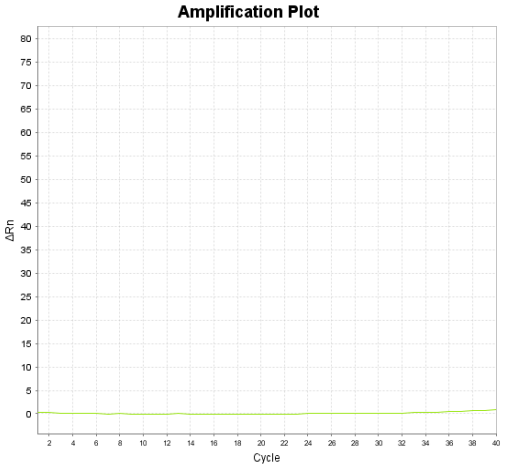


Figure 10: Reference Gene For 12 h sample

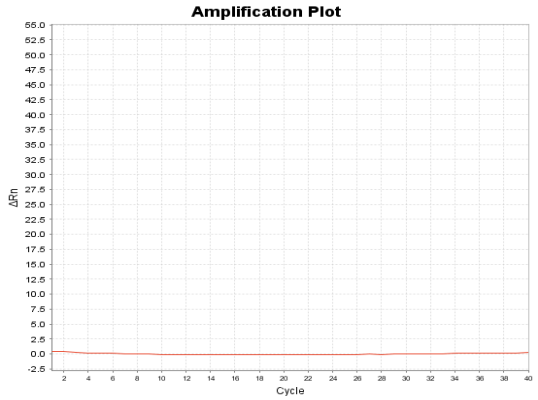


Table 3

Sample	Ct (reference gene)	Ct (endogenous control)
Untreated	10.78	10.59
Treated (non-germinated)	27.58	31.06
Treated (germinated)	Undetermined	Undetermined

From sensory Evaluation (Figure 11, 12)

Figure 11: Sensory Evaluation of Products

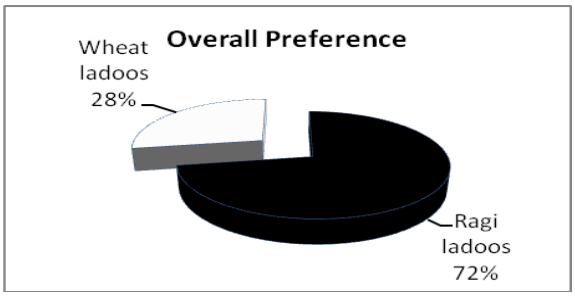
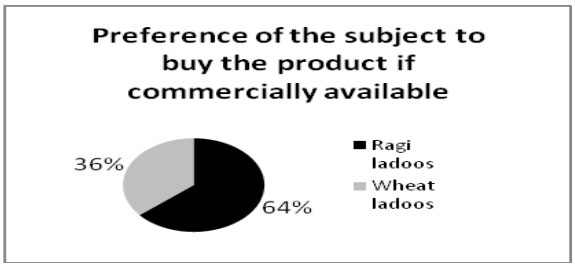


Figure 12: Preference of the Subject



CONCLUSION

Finger millet occupy an important place in the world food and economy. They can adapt themselves to marginal soils and varied environmental conditions. Finger millets are the staple diet for nearly 1/3rd of the world's population. By considering these points an evaluation of proximate principles, Antimicrobial, and organoleptic studies was conducted. Finger millet contain large quantities of all the essential aspects and posses antibacterial activity which prevent deterioration of human health.

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