# FORMULATION OF CALCIUM ENRICHED FINGER MILLET HERBAL DRINK-TISANE


## ABSTRACT

Calcium-rich Ragi tisane is a novel beverage developed to enhance dietary calcium intake through the utilization of Ragi (finger millet), a staple grain known for its high calcium content. This study explores two methods for optimizing the calcium richness of Ragi tisane. The first method involves roasting ragi and combining it with spice powder, while the second method includes soaking, cabinet drying, roasting, and then blending Ragi with spice powder. Both treatments were evaluated for their calcium content and overall quality. Results indicate that the second method, which incorporates soaking and drying processes before roasting, significantly increases the calcium concentration in the tisane. The final product is enriched with additional nutrients from a blend of dry ginger, cinnamon, cardamom, Arjuna bark, fennel seeds, and Tulsi leaves, making it a healthful and calcium-fortified beverage. The maximum value of calcium (396mg) was observed in $T_2$ whereas the minimum value of calcium (380 mg) was observed in $T_1$.This Ragi tisane presents a valuable option for improving calcium intake in the diet, particularly for individuals with specific nutritional needs.



**Keywords:** Tisane, Calcium, Ragi, Herbal tea, Infusion




## 1. INTRODUCTION:

Tisane is an infusion beverage composed of a mixture of various ingredients such as leaves, seeds, herbs, legumes, tree bark, fruits, or flowers that are dried, or parts of plants that provide aroma and flavour while also being beneficial for health. Tisanes can offer health benefits such as antioxidant, antimicrobial, antihemolytic, and cytotoxic activities. (Aoshima*et al.*, 2007).

Tisane, also known as herbal tea, is a beverage made from the infusion or decoction of herbs, spices, flowers, fruits, and other plant materials, excluding the leaves of the tea plant (Camellia sinensis). Unlike traditional tea, tisanes are naturally caffeine-free, making them a

popular choice for those looking to reduce their caffeine intake. (Indrawatiand Yulianto, 2023)

Health-based natural ingredient beverages have become an alternative for health-conscious individuals. The increasing awareness of a healthy lifestyle among the public is reflected in the healthy living patterns adopted in their daily lives. In addition to consuming healthy food daily, beverages that support health are gaining popularity, and one of these is tisane. (Baba *et al.*, 2009).

Tisane has become popular among tea enthusiasts because, besides its pleasant taste and aroma, it offers health benefits and relaxation. Regular consumption of tisane can be used as a therapeutic treatment to improve heart health, address digestive issues, boost energy and vitality, enhance the immune system, provide essential antioxidants for the body, reduce stress, improve sleep quality, and stimulate the functioning of various organs (Ravikumar, 2014).

Tisanes are a potential source of phytochemicals to reduce disease risk conditions and are used to protect from non-communicable diseases, globally. A few tisanes have gained more popularity than others depending on their chemical composition based on the geographical origin of the used herb. Several Indian tisanes have been claimed to have traits beneficial to people with or at a high risk of type 2 diabetes mellitus (Joshi *et al.*, 2023)

Tisanes have long since been used in many traditional medicinal systems to reduce the burden of diseases. There are several kinds of tisanes (infusions/decoctions), which are consumed for energising and reducing tension and anxiety to curb gastrointestinal problems and boost the body's immunity. Some of these tisanes possess extremely strong medicinal benefits that are used to treat inflammations, bacterial, and viral infections, and even help patients living with HIV and AIDS, so researchers are exploring and vouching for different tisanes from time to time. (Etheridge and Derbyshire, 2019).

Hence, this study has been planned to formulate tisane from finger millet with rich calcium to enhance the consumption of finger millet in daily diet as an easiest way.

## 2.MATERIALS AND METHODS

### *2.1. Roasting of Ragi:*

The raw Ragi, sourced from the local market, is subjected to a roasting process. This is done in a roasting pan, maintaining a temperature range of approximately 80-85°C. The roasting continues until the characteristic aroma of the Ragi is detected. Subsequently, the

roasted Ragi is allowed to cool to ambient temperature. Once cooled, it is coarsely ground into a powder form.

***2.2 Soaking and roasting of Ragi:***

The Ragi procured from the local market is soaked in water for approximately 24 hours. Following this soaking period, the Ragi is dried in a cabinet dryer at 70°C for 30 hours. The dried Ragi is then pan roasted at 80°C until a characteristic aroma is obtained. After cooling to ambient temperature, the roasted Ragi is coarsely ground into a powder.

***2.3. Preparation of spice powder:***

The whole spices procured from the local market, including cardamom, cinnamon, dry ginger, fennel seeds, and Arjuna bark, are roasted in a pan. Once cooled, these roasted spices are finely powdered. Dried Tulsi leaves are then added to the powdered spice mixture.

***2.4 .Procedure for preparation of tea bag*:**

The ground Ragi from both treatments is taken. The ground spice powder is mixed with the coarsely ground Ragi in a 1:1 ratio. This mixture is then placed into empty tea dip bags.

***2.5 Procedure for preparation of Ragi Tisane:***

The prepared tea bags are immersed in boiling hot water and allowed to steep for 5 minutes. The infusion is then served with the addition of jaggery, lemon juice, and black salt.

**Table 1: Details of Treatments:**

| S. No | Treatment number | Name of the Treatment |
|---|---|---|
| 1 | Treatment 1($T_1$) | Roasting |
| 2 | Treatment 2($T_2$) | Soaking and roasting |

***2.6 .Physical characteristics:***

Diffusion is described as the transfer of chemicals from a high concentration area to a low concentration area. There are several molecules within the herbal infusion bags which cannot flow through the bags, but smaller particles comprising essence, color, and taste may diffuse through the membrane of the bags. Heat from boiling water enables the molecules in the infused substance to move significantly quicker than they would at a normal temperature.(Spiro &Jaganyi, 2000)

**2.7.*Bio-Chemical characteristics:***

The chemical characteristics of the Ragi tisane were evaluated. Some of the chemical characteristics such as moisture (AOAC *et al.*, 1995.),protein (Hayes, 2020), ash (AOAC, 2005), pH (Ranganna, 1977), ascorbic acid (Gunashree *et al.*, 2014) and calcium (Ranganna, 1977) are discussed.The moisture content is done by hot air oven method, protein content by analysed bythe Kjeldahl method and the ash content was done by muffle furnace effectively.

**2.8.*Organoleptic characteristics*:**

Sensory evaluation was conducted to evaluate the organoleptic characters of ragi tisane. A panel of ten trained judges and evaluated the tea bags at an interval of once in 15 days for a period of 30 days. The organoleptic evaluation sessions were conducted one hour before lunch under adequate conditions of temperature, humidity and illumination. The panellists were asked to score the colour, appearance, flavour, texture, taste and overall acceptability of the above mixes on a scale of 9 to 1 hedonic scale.

**3. RESULTS AND DISCUSSIONS**

The results obtained from the present investigation entitled "Formulation of calcium enriched finger millet herbal drink -Tisane" is presented in this chapter. The findings of the experiment are presented in the preceding chapter revealed that the effect of tisane and treatment significantly influenced the physical-chemical characteristics during the storage period of 1 month. In the ensuring pages efforts has been made to establish causes and effects of relationship amongst various parameters, which were found to be influenced significantly.

**3.1 Physical characteristics of Calcium rich Ragi Tisane:**

The results of physical characteristics of calcium-rich ragi tisane with different treatments are discussed. Each tea bag of both the treatments ($T_1$ and $T_2$) was soaked for 5 min in 125 mL of preheated (100 °C) water before being removed and dried in a hot air oven until no further drying occurred. Each bag was then weighed.

The physical characteristics of calcium-rich ragi tisane were evaluated by analyzing the solubility index. After soaking each tea bag ($T_1$ and $T_2$) in 125 mL of preheated water (100 °C) for 5 minutes, the bags were dried in a hot air oven until no further weight change occurred. The solubility index can be inferred from the weight difference, indicating how much of the bioactive components, such as calcium, dissolved into the water. Treatment 2 ($T_2$), involving soaking, drying, and roasting, is likely to show a higher solubility index

compared to Treatment 1 ($T_1$), due to enhanced structural breakdown during the additional processing steps, leading to better extraction of soluble compounds.

**3.2 Bio-Chemical characteristics of Calcium rich Ragi Tisane:**

The results ofbio chemical characteristics of calcium-rich ragi tisane with different treatments are discussed.

List 1. Bio-Chemical characteristics of Calcium rich Ragi Tisane

| **Nutritional parameters** | **Treatment 1** | **Treatment 2** |
|---|---|---|
| **Moisture (%)** | 3.5 | 4.3 |
| **Protein (g/100g)** | 7.4 | 7.8 |
| **pH** | 6.5 | 6.8 |
| **Vitamin C (mg/100g)** | 20 | 30 |
| **Calcium (mg/100g)** | 380 | 396 |

The maximum value of moisture (4.3%) was observed in $T_2$, whereas minimum moisture (3.5%) was observed in $T_1$ on 15 days of storage.$T_2$ has increased moisture content due to additional soaking when compared to $T_1$.Balkrishna and Visvanathan, 2019 stated that increased soaking time leads to significant increase in moisture content of ragi.

The maximum value of protein (7.8 g) was observed in $T_2$ whereas minimum value of protein (7.4 g) was observed in $T_1$.Shingote*et al*. (2021) examined the effects of various pretreatments on the nutritional composition of sorghum, green gram, and ragi. It specifically highlights that soaking ragi leads to a notable increase in its protein content. The soaking process activates certain enzymes and enhances the bioavailability of nutrients, which contributes to this increase. The study suggests that soaking not only improves the nutritional profile of ragi but also makes it more digestible, thus enhancing its overall health benefits. This finding underscores the importance of pretreatment methods like soaking in maximizing the nutritional value of ragi grains.

The maximum value of pH (6.8) was observed in $T_2$ whereas the minimum value of pH (6.5) was observed in $T_2$. The maximum value of ascorbic acid was observed in $T_2$ (30 mcg) whereas the minimum value of ascorbic acid (20 mcg) was observed in $T_1$.Bhagat*et al.*, 2020, revealed that soaking ragi significantly increased its vitamin c levels which are

attributed by the activation of certain enzymes during the soaking process, which enhances the bioavailability of nutrients.

The maximum value of calcium (396mg) was observed in $T_2$ whereas the minimum value of calcium (380 mg) was observed in $T_1$. The results indicated that $T_2$ treatment have higher nutrientcontent whereas compared to $T_1$ due to the combination of soaking and roasting.Anitha *et al*. 2021, provided a systematic review and meta-analysis on calcium retention from finger millet (ragi), specifically noting the effects of soaking on its calcium content. Soaking ragi is shown to enhance the bioavailability of calcium, making it more accessible for absorption in the body. The review highlights that soaking reduces antinutritional factors such as phytic acid, which can inhibit calcium absorption, thereby increasing the effective calcium content that can be retained during digestion.

### 3.3 Organoleptic evaluation of calcium rich ragi tisane:

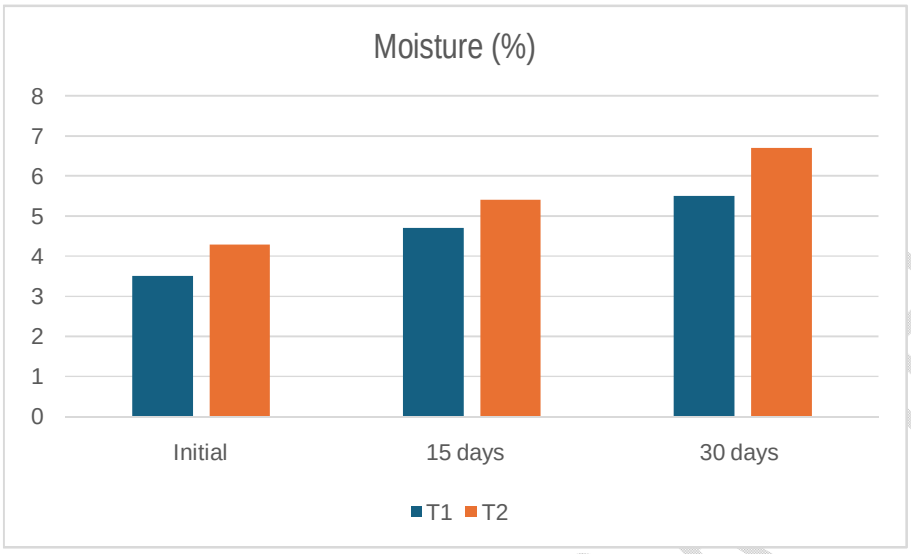
**List 2.** Organoleptic evaluation of calcium rich ragi tisane

| Sensory Parameters | Treatment 1 | Treatment 2 |
|---|---|---|
| **Appearance** | 9.0 | 8.7 |
| **Colour** | 9.0 | 8.7 |
| **Flavour** | 7.8 | 8.5 |
| **Taste** | 8.6 | 9.0 |
| **Overall acceptability** | 8.3 | 8.9 |

The results of organoleptic evaluation of calcium-rich ragi tisane with different treatments are discussed.The maximum score of appearance (9.0) was observed in $T_1$, whereas minimum score of appearance (8.7) was observed in T2 on 15 days of storage. The maximum score of colour (9.0) was observed in $T_1$ whereas minimum score of color (8.7) was observed in $T_2$. The maximum score of flavour (8.5) was observed in $T_2$ whereas the minimum score of flavour (7.8) was observed in $T_2$. The maximum score of taste (9.0) was observed in $T_2$ whereas the minimum score of taste (8.6) was observed in $T_1$. The maximum

value of overall acceptability (8.9) was observed in T2 whereas the minimum value of overall acceptability (8.3) was observed in $T_1$.

**Fig 1. Effect of recipe treatments on moisture of Calcium rich Ragi Tisane**



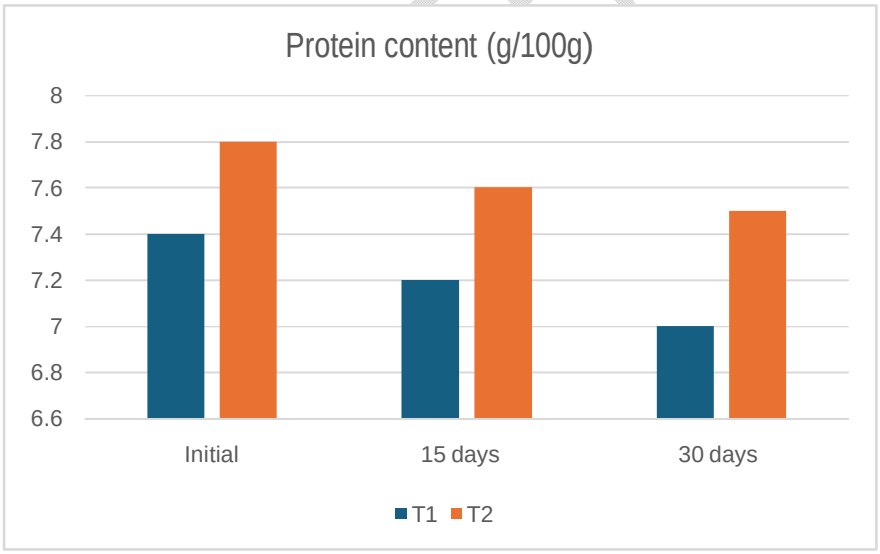




**Fig 2. Effect of recipe treatments on protein content of Calcium rich Ragi Tisan**

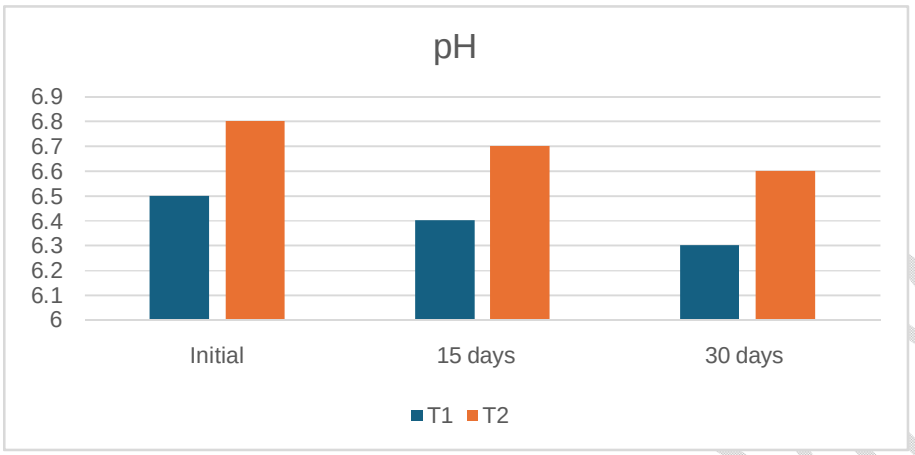



**Fig 3. Effect of treatments on pH of Calcium rich Ragi Tisane**

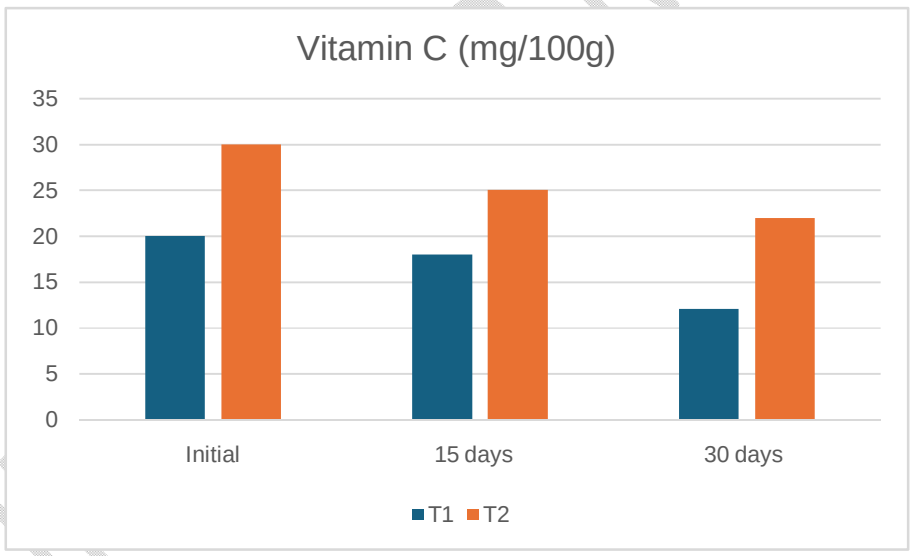



**Fig4. Effect of treatments combination on Ascorbic acid of Calcium rich Ragi Tisane**

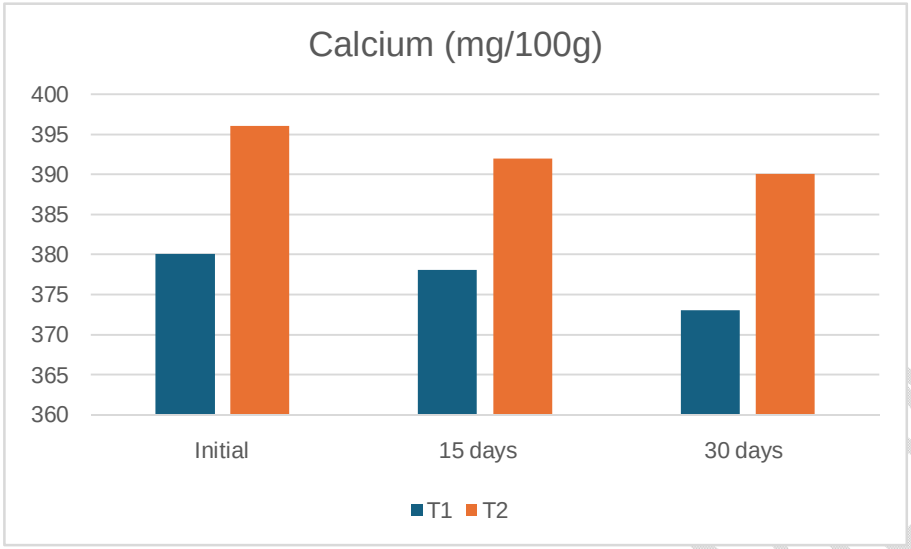



**Fig 5. Effect of Treatments on calcium content of calcium rich Ragi tisane**

## 4. CONCLUSION:

The study successfully demonstrated the potential of Ragi tisane as a calcium-rich beverage, particularly when employing the more elaborate preparation method outlined in Treatment 2. The enhanced calcium content observed in this treatment underscores the importance of processing methods in optimizing the nutritional value of functional foods. As such, the calcium-rich Ragi tisane developed through this project holds promise as a valuable addition to the market, catering to consumers seeking healthful and nutrient-dense beverage options. Further exploration into the stability and consumer acceptability of this product is recommended to fully realize its commercial potential.

**Future scope:**

This study helps to increase the consumption of our traditional foods in easy form and creates interest to formulate suitability of other millets in tisane development.

**DISCLAIMER (ARTIFICIAL INTELLIGENCE)**

Author(s) hereby declare that NOgenerative AI technologies such as Large Language Models (ChatGPT, COPILOT,etc) and text-to-image generators havebeen used during writing or editing of this manuscript.

## REFERENCES:

1. Anitha, S., Givens, D. I., Botha, R., Kane-Potaka, J., Sulaiman, N. L. B., Tsusaka, T. W., Subramaniam, K., Rajendran, A., Parasannanavar, D. J., Bhandari, R. K. Calcium from Finger Millet—A Systematic Review and Meta-Analysis on

Calcium Retention, Bone Resorption, and In Vitro Bioavailability. Sustainability, 2021; 13(16), 8677. https://doi.org/10.3390/su13168677

2. AOAC, Benjakul, Robinson, Hodgen, Leammli. (n.d.). Analytical Methods. 1995. https://kb.psu.ac.th/psukb/bitstream/2553/1573/2/271250_app.pdf
3. AOAC.Determination of total ash[LaboratoryProcedure2005.https://www.dairyknowledge.in/sites/default/files/7.2.pdf
4. Aoshima H, Hirata S, Ayabe, S. Antioxidative and anti-hydrogen peroxide activities of various herbal teas. Food Chemistry, 2007; 103(2), 617–622. https://doi.org/10.1016/j.foodchem.2006.08.032
5. Baba, H, Ohtsuka, Y, Haruna, H, Lee, T, Nagata, S, Maeda, M, Yamashiro, Y, Shimizu, T. Studies of anti□inflammatory effects of Rooibos tea in rats. Pediatrics International, 2009; 51(5), 700–704. https://doi.org/10.1111/j.1442-200x.2009.02835.x
6. Balkrishna, S. P, and Visvanathan, R. Hydration kinetics of little millet and proso millet grains: effect of soaking temperature. Journal of Food Science and Technology, 2019; 56(7), 3534–3539. https://doi.org/10.1007/s13197-019-03789-4
7. Bhagat, K., NadkarnI, M., Ruparel, M., Devkatte, A., Chaudhari, D. Formulation Of Cereal-Based Beverage Enriched With Vitamin C, Dietary Fibers And Micronutrients. In JETIR 2020; Vol. 7(8) https://www.jetir.org/papers/JETIR2008295.pdf
8. Etheridge, C. J,Derbyshire, E. Herbal infusions and health. Nutrition & Food Science, 2019; 50(5), 969–985. https://doi.org/10.1108/nfs-08-2019-0263
9. Gunashree, B. S., Selva Kumar, R., Roobini, R., Venkateswaran, G., Nutrients and antinutrients of ragi and wheat as influenced by traditional processes. Int.J.Curr.Microbiol.App.Sci, 2020; 3(7), 720–736. https://www.ijcmas.com/vol-3-7/B.S.Gunashree,%20et%20al.pdf
10. Hayes, M. Measuring Protein Content in Food: An Overview of Methods. Foods, 2020; 9(10), 1340. https://doi.org/10.3390/foods9101340
11. Indrawati, I, Yulianto, Y. TISANE CELERY AS A NON-MEDICAL THERAPY IN HYPERTENSION PATIENTS. Proceeding of International Conference of Kerta Cendekia, 2023; 2(1), 174–181. https://doi.org/10.36720/ickc.v2i1.519

12. Joshi, D. D., Deb, L., Somkuwar, B. G, Rana, V. S. Relevance of Indian traditional tisanes in the management of type 2 diabetes mellitus: A review. Saudi Pharmaceutical Journal, 2023; 31(5), 626–638. https://doi.org/10.1016/j.jsps.2023.03.003
13. Kumar, V., Sharma, N., Saini, R., Mall, S., Zengin, G., Sourirajan, A., Khosla, P. K., Dev, K., & El-Shazly, M. Therapeutic potential and industrial applications of Terminalia arjuna bark. Journal of Ethnopharmacology, 2023; 310, 116352. https://doi.org/10.1016/j.jep.2023.116352
14. Ranganna, S. (1977). Manual of Analysis of Fruit and Vegetable Products. TATA Mcgraw – Hill, Newyork.
15. Shingote, A. B., Jr., Sadawarte, S. K., Gaikwad, K. K., Gajmal, D. B., Pawar, V. S., Department of Food Process Technology, College of Food Technology, Effect of Pretreatments on Nutritional Composition of Sorghum, Green Gram and Ragi. In Biological Forum – an International Journal 2021; (Vol. 13, Issue 1, pp. 500–505)
16. Spiro, M., Jaganyi, D. 2000b. Kinetics and equilibria of tea infusion, Transport of caffeine across a teabag membrane in a modified rotating diffusion cell. Food Chemistry, 69(2), 119–124. https://doi.org/10.1016/s0308-8146(99)00251-4