

## Effect of germination and fermentation on the antioxidant activity of millet koozh prepared using sorghum bicolor (*Monech. L*), pearl millet (*Pennisetum glaucum*) and finger millet (*Eleusine coracana*)

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### Abstract

Millet Koozh is a product of double fermentation of millet and rice caused by a mixture of micro flora involving lactic acid bacteria and yeast.

**Objective:** This study was undertaken to evaluate the antioxidant activity of the koozh prepared using Red and white varieties of sorghum (*L. Moench*), pearl millet (*Pennisetum glaucum*) and Finger millet (*Eleusine coracana*). Antioxidant activity of any compound of interest is widely evaluated by its radical scavenging activity.

**Method:** The DPPH assay was used to study the radical scavenging activity of Millet Koozh prepared using varying combinations of processing methods such as germination and fermentation.

**Results:** It was observed that all the millet koozh samples exhibited good antioxidant activity of above 65 percent. The non-germinated and fermented millet koozh exhibited the highest antioxidant activity score of 83.65 percent followed by the non-germinated & non-fermented koozh (81.05 percent). But the lowest antioxidant activity was exhibited by the germinated and fermented millet koozh.

**Conclusion:** This study found that using non-germinated millets in the preparation of fermented millet koozh results in maximum antioxidant activity. Whereas using germinated millets in the preparation of fermented millet koozh brought about a reduction in the antioxidant activity.

**Keywords:** millets, koozh, antioxidant activity, radical scavenging activity, germination, fermentation

### Introduction

Millets are a group of highly variable small-seeded grasses, belonging to the family *Poaceae*. They are widely grown around the world as cereal crops or grains for both human food, fodder, and as a bird feed [1].

Different methods of processing such as germination and fermentation enhance the nutrient profile of millets. Several traditional household food processing and preparation methods are used to enhance the bioavailability of micronutrients from millets. These include thermal processing, mechanical processing, soaking, fermentation and germination/malting. These procedures aim to increase the physiochemical accessibility of micronutrients and decrease the content of antinutrients such as phytates.

Koozh is a soft porridge prepared from traditionally processed millet (germinated and fermented). Preparation of Koozh involves two fermentation processes, before (primary fermentation) and after cooking (secondary fermentation). During fermentation, the millet slurry would undergo major biochemical changes like starch hydrolysis, sugar transformation and softening. So the conventional process of fermentation is believed to increase the nutritive value of millets [3]. Enhancement of Biological Value (BV), Net Protein Utilization (NPU), and Thiamine, Riboflavin, and Niacin contents have been shown in fermented finger millet Koozh which is one of the popularly consumed millet based fermented beverages of South India [4].

### Background for the study

Refined flour products are on the rise along with their plethora of health consequences. To quell the stigma of obesity and other life style disease conditions, there is a need to provide more healthy whole grain substitutes for refined carbohydrates, which can form an important aspect in dietary modifications. One such way is by including millets in our diet. Koozh (fermented porridge) prepared from millets have high nutritional quality. Phenols are responsible for antioxidant properties of foods. Millets contain phenolic acids, which are located in the pericarp, testa, aleurone layer and endosperm that are responsible for their antioxidant properties [5]. It has been found that whole millets are rich in these antioxidant components [6].

### Objective of the study

To assess the influence of germination and fermentation on the antioxidant activity of millet koozh (prepared using finger millet, pearl millet, Red sorghum & white sorghum and broken raw rice) in the following combination of processing methods

- Non-germinated and Non-fermented millet Koozh
- Non- Germinated and fermented millet koozh.
- Germinated and Fermented millet koozh.
- Germinated and Non-fermented millet Koozh

**Materials and Methodology**

**Research Design**

The research design of this study is experimental in nature. Red and white varieties of sorghum (*L.Moench*), pearl (*glaucum*) and Finger millet (*Eleusine coracana*) were selected for the study. The millets were obtained from the millet retailer supplying at the Tamil Nadu Agricultural University Centre at Chennai. Broken Ponni raw rice (Noyee) was procured from the grocery.

**Stages in the preparation of millet koozh**

**A. Preparation of the millet slurry**

1. All the millets were taken in the ratio of 1:1:1:1 (15g each)
2. The flours were mixed with 200ml of water so as to make a smooth slurry.

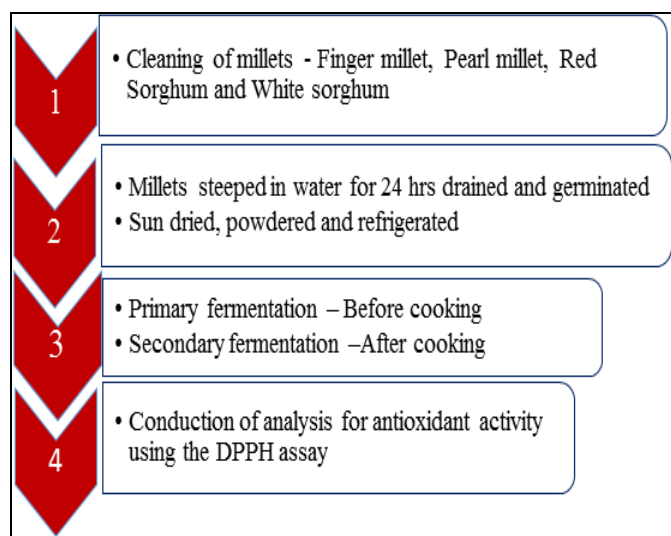
3. This was allowed to ferment naturally for 24 h (Primary fermentation)

**B. Cooking of the millet slurry to a koozh**

1. To 400ml of boiling RO water in an earthen pot, broken raw rice was added and cooked.
2. When the rice was cooked well, the fermented millet slurry was added and continuously stirred until it was cooked and reached a koozh consistency.
3. The koozh was cooled, covered and allowed to ferment a second time for 12h (Secondary fermentation)

Millet Koozh was prepared in four different combinations of processing methods as shown in the following table. The steps included and omitted in the preparation of millet koozh using the four processing methods are also spelt out. This was done to find out the actual effect of germination and fermentation on the antioxidant of millet koozh.

Processing methods	Steps adopted and omitted in the preparation of millet koozh
Non-germinated and Non-fermented millet koozh	No germination of millets and fermentation of millet koozh
Non- Germinated and fermented millet koozh	No germination of millets but only fermentation of millet koozh
Germinated and Fermented millet koozh	Germination and fermentation adopted in the preparation of millet koozh
Germinated and Non-fermented millet koozh	Only germination of millets but no fermentation of millet koozh



**Results and Discussion**

**Radical scavenging activity of millet koozh**

Koozh is a traditional fermented millet beverage unique to south India. Traditionally, koozh is considered nutritious and health promoting. The nature of the koozh varies based on the characteristics of the millets used and the preparation procedure followed which varies in rural and urban areas. In this study the combined effect of germination and fermentation of millets such as finger millet, pearl millet, red sorghum and white sorghum used in the preparation of millet koozh on its antioxidant activity was investigated.

Antioxidant activity of any compound of interest is widely evaluated by its radical scavenging activity. The DPPH (1,1-diphenyl-2-picrylhydrazyl) assay was used to study the radical scavenging activity of millet koozh prepared using varying combinations of processing methods. The findings are tabulated

**Table 1:** Antioxidant activity of millet koozh prepared using varying combinations of processing methods

Processing method	Radical Scavenging activity in Percentage
Non-Germinated & Non-fermented (NG & NF)	81.05
Non-Germinated & Fermented (NG& F)	83.65
Germinated & Non-fermented (G&NF)	74.39
Germinated & Fermented (G & F)	66.43

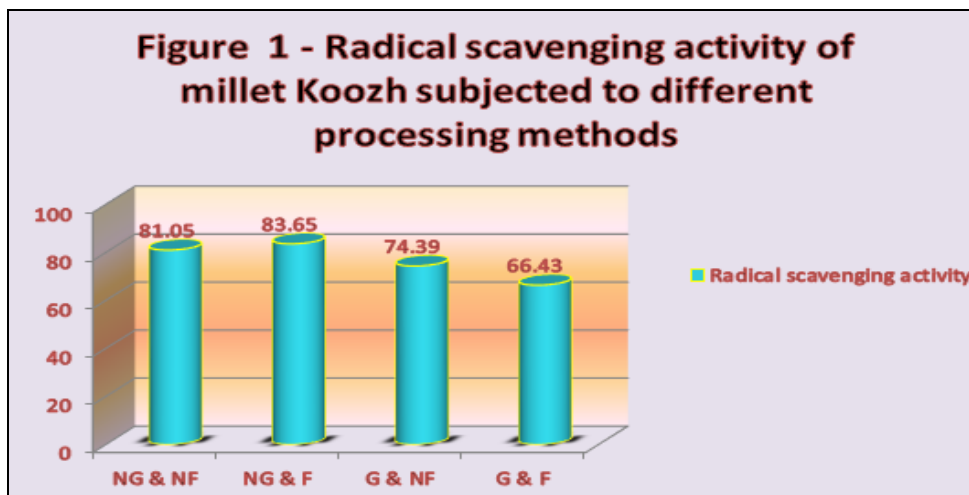
It is observed from table 1 that all the millet koozh samples exhibited good antioxidant activity of above 65 percent. The non- germinated and fermented millet koozh exhibited the highest antioxidant activity score of 83.65 percent followed by the non-germinated & non-fermented koozh (81.05 percent). However this was only a marginal difference. Millets contain phenolic acids that have excellent antioxidant properties. Finger millets are one of the richest sources of polyphenols [7]. In the present study, the antioxidant activity of germinated and non-fermented millet koozh was 74.39 percent in comparison to 66.43 percent in the germinated & fermented millet koozh.

Though germination and fermentation brought about a reduction in the antioxidant activity, the values were above 65 per cent for different processing methods which shows that the millet koozh is still a good source of natural antioxidants. Flavonoids and tannins present in millet seed coat are multifunctional and they act as reducing agents (free radical terminators), metal chelators and singlet oxygen quenchers. Finger millet is a potent source of antioxidants and has high radical-scavenging activity which is higher than that of wheat, rice and other millets. Finger millet extracts were also found to have a potent radical-scavenging activity that is higher than

those of wheat, rice and other species of millets [8]. Thus the high antioxidant activity exhibited by the millet koozh in this study can also be attributed to the usage of finger millet in the preparation.

Millet koozh can thus serve as an excellent natural source of antioxidants. It is ideal for convalescents and can be

recommended as a weaning food, compared to expensive commercially available formulas. The introduction of millets into the Public Distribution System and into government meal programmes like the mid-day meal scheme can help the poor and the marginalized households in meeting their food and nutrition needs.



### Conclusion

Millet koozh is a healthful wholesome food as it is enriched with vitamins, minerals, protein and dietary fibre. It can be used as an affordable nutritious supplement in place of expensive commercial formulas. It can be recommended as a nutritious mid-morning health drink for school children. Fermented millet porridge could serve as a natural source of antioxidants at an affordable cost for all strata of society across all age groups.

### References

1. Palanisamy Bruntha Devi, *et al.* Rajendran Vijayabharathi, Sathyaseelan Sathyabama, Nagappa Gurusiddappa Malleshi, and Venkatesan Brindha Priyadarisini. Health benefits of finger millet (*Eleusinecoracana* L.) polyphenols and dietary fiber: a review J Food Sci Technol. 2014; 51(6):1021-1040.
2. Hotz C, Gibson RS. Traditional food-processing and preparation practices to enhance the bioavailability of micronutrients in plant-based diets”, Journal of Nutrition. 2007; 137(4):1097-1100.
3. Sekar S, Mariappan S. Usage of traditional fermented products by Indian rural folks and IPL, Indian journal of traditional knowledge. 2007, 111-120
4. Rajyalakshmi P, Geervani P. Studies on tribal foods of South India: Effect of processing methods on the vitamin and *invitro* protein digestibility (IVPD) of cereals/millets and legumes. J. Food Sci. Technol. 1990; 27:260-263.
5. McDonough CM, Rooney LW, Serna-saldivar SO, *et al.* The millets. In: Handbook of Cereal Science and Technology. Kulp K, Ponte Jr.(Ed.). Marcel Dekker. 2000, 177-201.
6. Aisha Siddiq A. Antioxidant properties of digestive enzyme-treated fibre-rich fractions from wheat, finger millet, pearl millet and sorghum, Journal cogent food and agriculture. 2015; 1:1073875.
7. Hegde PS, Chandra TS. ESR spectroscopic study reveals higher free radical quenching potential in kodo millet

(*Paspalum scrobiculatum*) compared to other millets. Food Chemistry. 2005; 92(1):177-182.

8. Dykes L, Rooney LW. Review: Sorghum and millet phenols and antioxidants. Journal Cereal Sci. 2006; 44:236-251.
9. Appaji M, Ashwini, Mala Majumdar. Quantification of phytochemical contents and *in vitro* antioxidant activity of *exacum bicolor* (roxb.), an endemic medicinal plant. 2015; 7:225-230
10. Sumathy Rengarajan, Comparative studies of antioxidant activity from the petals of selected Indian medicinal plants, International Journal of Pharmacy and Pharmaceutical Sciences. 2015; 7(6):29-34.