

Effect of Soaking and Germination on the Tannin Content In Pearl Millet

G Keerthana

PG Final Year Student, Department of Food Science and Nutrition, Padmashree Institute of Management and Sciences,
Karnataka, India

ABSTRACT: Millets are unique among the cereals because of their richness in calcium, dietary fibre, polyphenols and protein. They are nutrients rich and recommended for the health and well-being of infants, lactating mothers, elderly and convalescents. One such millet rich in polyphenols is pearl millet. Pearl millet, is referred as the “magical pearl” It is a gluten free grain and it is noted for its high iron content. It has immense health benefits and uses. Pearl millet was soaked overnight and germinated for two, three and four days and powdered for further analysis. The tannin content of the powder was determined after which a traditional snack named Nimki was prepared by incorporating 10g of germinated millet flour with other ingredients. The acceptability of the product was evaluated by performing sensory evaluation. The present project work results reveal that germination has shown significant changes in pearl millet. Soaking and germination has decreased the hydrolysable tannin and condensed tannin in pearl millet as the germination period increases significantly. In addition, germination has decreased the phenolic contents in the millet flour. The product prepared using the germinated millet flour was highly acceptable for its flavour.

KEYWORDS: Millets, soaking, germination, phenolic content, hydrolysable tannin, condensed tannin, nimki.

I. INTRODUCTION

Millets are a group of small-seeded grasses in the family Poaceae widely grown around the world as cereal crops or grains for fodder and human food. Among these, the pearl millet (*Pennisetum glaucum*) is of great importance, as it is uniquely adapted to adverse environmental conditions such as drought, low soil fertility and high temperatures. It is the staff of life for millions in regions where no other cereal can live. India is the world’s largest producer of pearl millet. The crop constitutes an important part of traditional diets in different states, with dishes like Sajje Rotti in Karnataka and Kambu dishes in Tamil Nadu (Leonardo Medici et al., 2017; Hanna, W. W. et al., 2004).

Pearl millet is recognized for its hardy nature and health benefits. They are an excellent source of calcium, iron, manganese and methionine, an essential amino acid often missing in starchy staple foods. Regular consumption of millets like pearl millet has been associated with a number of health benefits including lower risk of type 2 diabetes, cardiovascular disease, inflammatory diseases, breast cancer, childhood asthma and higher energy levels (Ishwarya A. L. et al., 2016; Dias-Martins et al., 2018).

Germination is an important process for better nutrition of millet. Millets soaked and sprouted have low levels of anti-nutritional factors like phytic acid and tannins which inhibit absorption of important minerals. Germination increases the amount and bioavailability of proteins, fats, calcium, iron and zinc and makes the millet more useful for human health (Swami, S. B. et al., 2013). Advantages can be utilized by development of new products such as Nimki (traditional Indian cracker) using germinated pearl millet flour. The study was designed to estimate the effect of germination on tannin content and sensory acceptability of Nimki prepared with different proportions of germinated millet flour and to contribute for nutritional enhancement and culinary creativity.

II. MATERIALS AND METHODS

2.1 Materials

Pearl millet grains for the present study were procured from a local supermarket in Bangalore.

2.2 Treatment of Millet

- **Cleaning:** The millet grains were cleaned thoroughly to remove glumes and damaged grains. The cleaned grains were divided into four equal parts of 250g for further treatments.
- **Soaking:** Part used as control (not soaked and not germinated). The other three parts were placed in purified water for 24 h to germinate.
- **Germination:** Grains were soaked and later wrapped in a wet muslin cloth after draining off the water. These batches were germinated at room temperature for 2, 3 and 4 days respectively.
- **Drying:** Sprouted millets were taken out from muslin cloth and roast dried over medium flame. This step lowered moisture content and prevented any further germination.
- **Milling:** The dried germinated millets were powdered to a fine powder using a domestic mixer, sieved and stored in air tight containers until analysis and preparation of product.

2.3 Determination of Total Phenols and Tannins

- **Stock solution preparation:** Each germinated millet flour sample was refluxed with 150ml distilled water at 85°C for 30 minutes and then cooled and centrifuged to obtain a clear stock solution (Marcos Aurelio Morais Galvao et al., 2018).
- **Total Phenolic Content:** 50µl of sample was diluted and mixed with Folin-Ciocalteu reagent and sodium carbonate, vortexed, incubated in dark for 40 minutes and the absorbance was read at 720nm. Results were expressed as mg gallic acid equivalent (GAE)/g (Sindhu S et al, 2019)
- **Hydrolysable Tannin Content:** Hydrolysable tannin content was determined by potassium iodate method. Potassium iodate was added to the sample. Absorbance was measured at 550nm. The results were expressed as mg of tannic acid equivalent (TAE)/g (Naima Rhazi et al., 2019).
- **Condensed Tannin Content:** Reaction with BuOH/HCl and ferrous solution, heating and absorbance reading at 530nm The results were expressed in mg of cyanidine equivalent (Cya)/g (Naima Rhazi et al., 2019).

2.4 Nimki Preparation

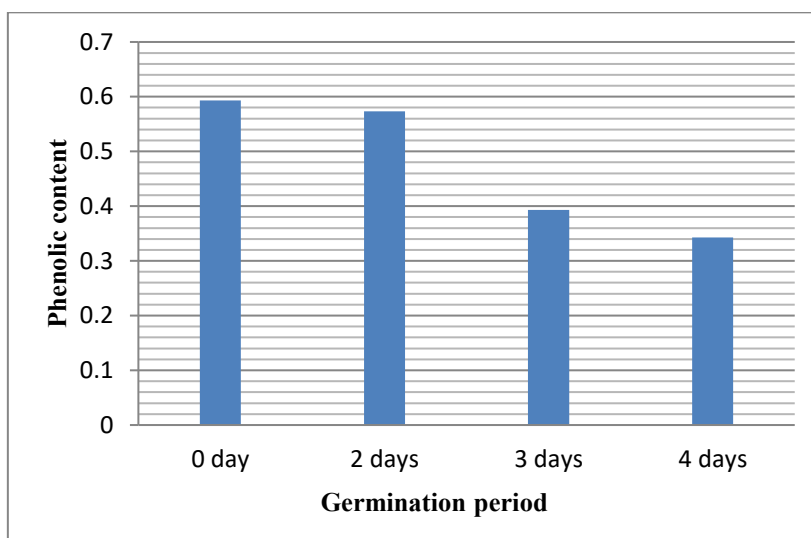
The wheat flour was mixed with germinated pearl millet flour in 10:20:30 ratios with salt, pepper powder, chilli powder, ghee and jeera. The ingredients were mixed with water to soft dough, rolled out, shaped and deep fried. For sensory evaluation and acceptability studies, the Nimki was prepared in three batches for three different flour ratios.

III. RESULTS AND DISCUSSIONS

3.1 Total Phenolic Content

Longer germination significantly reduced the total phenolic content of the millet flour. The values ranged from 0.593 mg GAE/g for raw seeds to 0.343 mg GAE/g for seeds germinated for 96 hours. The phenolic contents decreased by 96 %, 66 % and 57 % after 48 h, 72 h and 96 h of germination respectively. This drastic reduction shows that phenolic compounds are broken down during the germination process, probably due to the increase in enzymatic activity during the sprouting process. (Swami, S. B. et al, 2013). The antioxidant properties are due to the phenolics but their reduction may also improve the digestibility and palatability of millet based products (Sindhu S, et al., 2019).

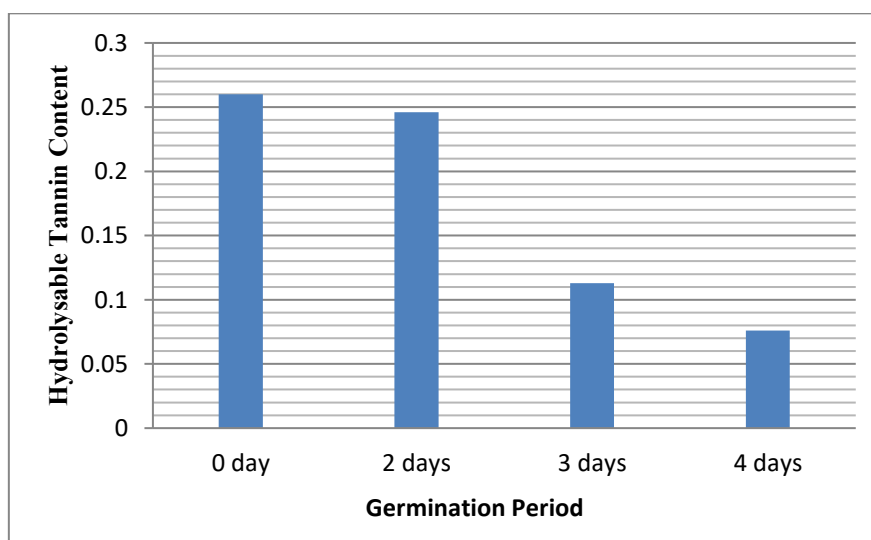
Graph 1: Total phenolic content



3.2 Hydrolyzable Tannin Content

The content of hydrolysable tannins varied between 0.076 mg TAE/g and 0.26 mg TAE/g. Germination resulted in significant decreases in the levels by 94% at 48 hours, 43% at 72 hours and 29% at 96 hours. Germination effectively reduces the anti-nutritional factors and significantly decreases the tannin content which may improve the bioavailability of minerals (e.g. iron and zinc) in the millet flour (Swami, S. B. et al., 2013). This enhancement is particularly advantageous for populations at risk of micronutrient deficiencies (Naima Rhazi, et al., 2019).

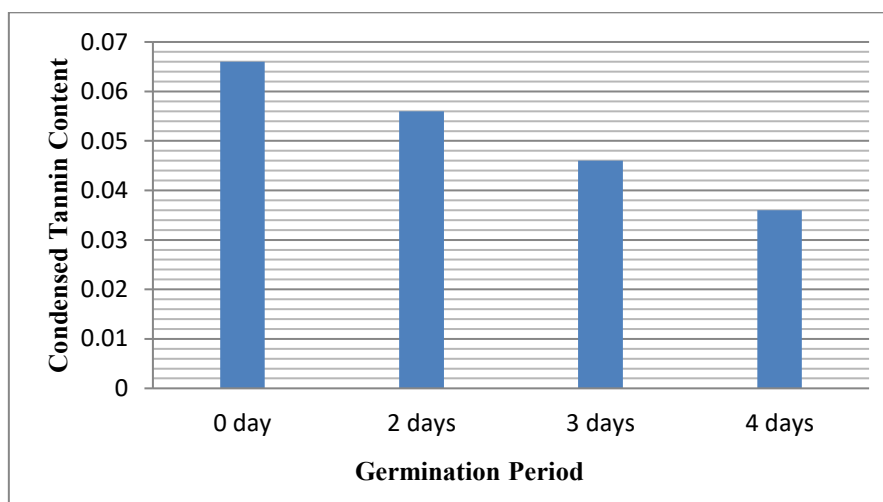
Graph 2: Hydrolysable tannin content



3.3 Condensed Tannin Content

Concentration of condensed tannins ranged from 0.036 mg Cya/g to 0.066 mg Cya/g. There was significant reduction of 84% after 48 hrs, 69% after 72 hrs and 54% after 96 hrs of germination. The decrease of condensed tannins during germination also reflects an enhancement in nutritive value as tannins may inhibit the absorption of proteins and enzymes (Naima Rhazi, et al., 2019). The decreased tannin level could be responsible for improved taste and acceptability of the product (Swami, S. B. et al., 2013).

Graph 3: Condensed tannin content



3.4 Nimki Preparation

The sensory evaluation results by hedonic scale showed that the nimki prepared from 10g germinated millet flour and 90g wheat flour was most preferred for flavor with mean score 8 (like very much). Untrained judges (students and faculty) have rated other sensory attributes like color and consistency high. Addition of germinated millet flour improved nutritional quality of nimki and also preserved or improved sensory characteristics. This allows us the opportunity of using germinated millet for traditional snacks without any reduction in consumer acceptance.

IV. CONCLUSION

The present project work results revealed that germination has shown significant changes in pearl millet. Soaking and germination has decreased the hydrolysable tannins and condensed tannins in pearl millet as the germination period increases. The hydrolysable tannin content was reduced by 94% in 48 hours, 43% in 72 hours and 29% in 96 hours of germination. The condensed tannin content was reduced by 84% in 48hours, 69% in 72 and 54% in 96 hours of germination. In addition, germination has decreased the phenolic contents in the millet flour. The phenolic content was reduced by 96% in 48 hours, 66% in 72 hours, and 57% in 96 hours of germination. This activity of decrease in the antioxidants suggests developing a nutrient rich product with germinated millet flours for therapeutic diets. The product prepared using this germinated millet flour was highly acceptable for its flavour. The present project work helped us to conclude that consuming germinated millet is better than consuming millet without germination.

REFERENCES

1. Medici, L. O., Goncalves, F. V., FONSECA, M. P. S., Gaziola, S. A., Schmidt, D., Azevedo, R. A., & Pimentel, C. (2018). Growth, yield and grain nutritional quality in three Brazilian pearl millets (*Pennisetumamericanum* L.) with African or Indian origins. *Anais da Academia Brasileira de Ciências*, 90, 1749-1758.
2. G. Bhuvaneshwaril, A. Nirmalakumari2, S. Kalaiselvi. Impact of soaking, sprouting on anti-oxidant anti-nutritional factors in millet grains. *Journal of Phytology* 2020, 12: 62-66
3. Bastos, A. O., Moreira, I., &Furlan, A. C. (2005). Chemical composition, nutrients and energy digestibility of pearl millets (*Pennisetumglaucum* (L.) R. Brown) fed to growing... *R. Bras. Zootec*, 34(2), 520-528.
4. Naima, R., Oumam, M., Hannache, H., Sesbou, A., Charrier, B., Pizzi, A., &Charrier-El Bouhtoury, F. (2015). Comparison of the impact of different extraction methods on polyphenols yields and tannins extracted from Moroccan *Acacia mollissima* barks. *Industrial Crops and Products*, 70, 245-252.
5. Rhazi, N., Hannache, H., Oumam, M., Sesbou, A., Charrier, B., Pizzi, A., &Charrier-El Bouhtoury, F. (2019). Green extraction process of tannins obtained from Moroccan *Acacia mollissima* barks by microwave: Modeling and optimization of the process using the response surface methodology RSM. *Arabian Journal of Chemistry*, 12(8), 2668-2684.

6. Galvão, M. A. M., Arruda, A. O. D., Bezerra, I. C. F., Ferreira, M. R. A., & Soares, L. A. L. (2018). Evaluation of the Folin-Ciocalteu method and quantification of total tannins in stem barks and pods from *Libidibiaferrea* (Mart. ex Tul) LP Queiroz. *Brazilian Archives of Biology and Technology*, 61.
7. Sindhu, S., & Radhai Sri, S. Antioxidant activity and Total Phenolic Content of Millet flour.
8. Iswarya, A. L., & Narayanan, A. (2017). Effect of germination on biofortified pearl millet cultivars' nutrient content. *Int. J. Innov. Res. Edu. Sci*, 3, 2349-5219.
9. Ocheme, O. B., & Chinma, C. E. (2008). Effects of soaking and germination on some physicochemical properties of millet flour for porridge production. *Journal of food Technology*, 6(5), 185-188.
10. Abioye, V. F., Ogunlakin, G. O., & Taiwo, G. (2018). Effect of germination on anti-oxidant activity, total phenols, flavonoids and anti-nutritional content of finger millet flour. *Journal of Food Processing & Technology*, 9(02), 1-5.
11. Kulla, S., Hymavathi, T. V., Kumari, B. A., Reddy, R. G., & Rani, C. V. D. (2021). Impact of germination on the nutritional, antioxidant and antinutrient characteristics of selected minor millet flours. *Ann. Phytomed. Int. J*, 10, 178-184.
12. Dias-Martins, A. M., Pessanha, K. L. F., Pacheco, S., Rodrigues, J. A. S., & Carvalho, C. W. P. (2018). Potential use of pearl millet (*Pennisetum glaucum* (L.) R. Br.) in Brazil: Food security, processing, health benefits and nutritional products. *Food research international*, 109, 175-186.
13. Hanna, W. W., Baltensperger, D. D., & Seetharam, A. (2004). Pearl millet and other millets. *Warm-season (C4) grasses*, 45, 537-560.
14. Swami, S. B., Thakor, N. J., & Gurav, H. S. (2013). Effect of soaking and malting on finger millet (*Eleusine Coracana*) grain. *Agricultural Engineering International: CIGR Journal*, 15(1), 194-200.
15. Sharma, S., Saxena, D. C., & Riar, C. S. (2016). Analysing the effect of germination on phenolics, dietary fibres, minerals and γ -amino butyric acid contents of barnyard millet (*Echinochloa frumentacea*). *Food Bioscience*, 13, 60-68.

APPENDIX

Table 1: Sensory Evaluation Table

Scores		Sample Code		
9.	Like extremely			
8.	Like very much			
7.	Like moderately			
6.	Like slightly			
5.	Neither like nor dislike			
4.	Dislike slightly			
3.	Dislike moderately			
2.	Dislike very much			
1.	Dislike extremely			



INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 9940 572 462  6381 907 438  ijirset@gmail.com



www.ijirset.com

Scan to save the contact details