Open Access

CARAS

© 2023, Centre for Advanced Research in Agricultural Sciences
Research Journal of Agricultural Sciences

ISSN: 0976-1675 (P)
ISSN: 2249-4538 (E)

International Conference on "Millets- Ensuring Food Security and Sustainable Farming"
Volume 14; Issue 04 (July-Aug 2023); pp 895–897

Full Length Research Article

Effect of Soaking and Germination on Anti-Nutrients and Anti-oxidant Activity of The Foxtail Millet Flour

D. Vijayarani*[1] and P. Saravana Prabha[2]

[1] Department of Home Science, V. V. Vanniaperumal College for Women, Virudhunagar - 626 001.Tamil Nadu, India
[2] Department of Home Science, Nutrition and Dietetics, V. V. Vanniaperumal College for Women,Virudhunagar - 626 001, Tamil Nadu, India

Correspondence to: D. Vijayarani, Department of Home Science, V. V. Vanniaperumal College for Women, Virudhunagar - 626 001.Tamil Nadu, India; E-mail: vijayarani@vvvcollege.org

Abstract

Millets are a group of cereal grains that belong to the *Poaceae* family, commonly known as the grass family. Millets have been neglected despite the nutritive value and therapeutic uses. *Setariaitalica* L., sometimes known as foxtail millet, is a highly nutritive, non-glutenous, and non-acid-forming food. They are rich source of protein, fibre and nutraceutical components. They are soothing and easy to digest. In the present study, foxtail millet was soaked at 8hrs, 12hrs, 16hrs, 20hrs and 24hrs and found the antinutritional factors present it. The research found that the millet soaked for 24 hours had less antinutritional factors compared than other soaking periods. Millets' bioavailability is improved by soaking and germination, which tend to diminish anti-nutrients and increase the solubility of minerals. Hence, the millet soaked for 24 hours was used for further analysis. The 24hrs soaked foxtail millet was germinated for 24hrs, 48hrs, 72hrs and 96hrs. The germinated foxtail millets were dried under sun drying and made into fine powder. The comparative analysis of an antioxidant activity showed that when the germination period increased the antioxidant activity was also increased. The foxtail millet soaked for 24hrs and germinated at 96hrs had high antioxidant activity of 94% and less antinutritional factors. So, the flour made from it was used for developing food products in order to combat malnutrition.

***Key words*:** Foxtail millet, Soaking, Germination, Anti-nutrients, Antioxidant

Eating is a must, but eating well takes skill. Obesity, diabetes, cardiovascular disease, gastrointestinal illnesses, and the risk of colon, breast, and oesophageal cancer have all increased due to people's overreliance on cereals following the green revolution and their current sedentary lifestyles. Moreover, these are also rich in dietary fiber and phenolic components, which are connected with their wide health benefits. Millets are a naturally occurring source of a variety of bioactive substances, such as phenolic acid, anthocyanins, and flavanols, which have antioxidant properties and serve as nutraceutical and functional food ingredients in the promotion of health and the lowering of the risk of degenerative diseases (Kayode *et al*. 2007, Rao *et al*. 2011, Sreera *et al*. 2009).

The most crucial factor in preserving human health and whole physical well-being is the nutritional value of food. since a person's ability to grow and maximize their genetic potential depends on their nutritional health. To preserve total human health and fitness to address the issue of severe malnutrition, dietary quality of food should be taken into consideration (Radhika *et al*. 2011, Singh *et al*. 2012).

Foxtail millet is a gluten-free, nutrient-rich whole-grain food. Compared with rice and wheat, it consists of quite a number vitamins, minerals, and excessive degree of protein. In addition to its wealthy nutrition, it additionally has a decrease glycemic index than the staple food made of rice and flour. In addition, foxtail millet contains certain polyphenols that are adjuvant treatments for diabetes, cancer, and cardiovascular disorders. Thus, foxtail millet has the potential to be used in functional foods (Yang *et al*. 2022). Foxtail millet is one of the minor millets, containing high amounts of proteins and minerals. Simple processing methods like dehulling, soaking and cooking are suggested to result in significant decreases in antinutrients and increased bioavailability of minerals like iron and zinc and also protein digestibility (Suma and Urooj 2012).

Soaking is the best practice for popular food preparation which reduces the anti-nutritional properties such as phytic acid (Bhuvaneshwari 2020). The process of germination improves the functional and nutritional qualities of grains as well as their digestibility (Imtiaz and Burhan-Uddin 2012). When the grain is rehydrated, germination takes place as a result of the reactivation of previously dormant enzymes, which increases metabolic activity. The metabolic activity results in the production of primary and secondary metabolites thereby improving the nutritional and functional properties of the grain (Bohoua and Yelakan 2007, Abbas and Mushara 2008) thereby the consumption of millets increases the nutritional status of the people. The main objectives of the present study was determine the anti-nutritional factor and antioxidant activity of the germinated foxtail millet subjected to different soaking and germination process.

MATERIALS AND METHODS

Collection of material

Foxtail millet grains were purchased from local market in Sivakasi**.** The raw purchased millets were placed in a tray and the damaged grains, stones or pebbles together with all other extragenous matter were removed by hand.

Preparation of foxtail millet flour

Preparation of foxtail millet flour soaked at various periodsdried by sun drying

The purchased foxtail millets free from extragenous matter were washed two times. Ingredients were individually soaked in water at different intervals (8hrs, 12hrs, 16hrs, 20hrs and 24hrs) and the water was drained. They were germinated separately for 48 hours and water was sprinkled occasionally to maintain the moisture. After uniform germination, the millets were placed on trays separately under direct sunlight. The millets took two days to dry in sun light and grinded by using milling machine and was stored separately in a container.

Determination of antinutritional activities of the germinated foxtail millet flour soaked at various periods dried by sun drying

The prepared germinated foxtail millet flours were subjected to anti-nutrient analysis. The extraction of prepared foxtail millet flour was obtained by dissolving 10g sample in 100ml of solvent ethanol. Then it is subjected to centrifuge at 3000rpm for about 15minutes. The supernant was collected. The ethanol extracts were subjected to preliminary qualitative anti-nutritional factor investigation such as Tannin, Saponin and phytic acid by using standard procedure. The germinated foxtail millet soaked at various intervals which has less antinutritional factors used for further study.

Preparation of germinated foxtail millet flour germinated at various periods dried by sun drying

Ingredients were individually soaked in water at 24hrs and the water was drained. They were germinated at different intervals (24hrs, 48hrs,72hrs and 96hrs) and water was sprinkled occasionally to maintain the moisture. After uniform germination, the millets were placed on trays separately under direct sunlight. The millets took two days to dry in sun light and grinded by using milling machine and was stored separately in a container for further analysis.

Determination and comparison of antioxidant activity

The extraction of prepared foxtail millet flour was obtained by dissolving 10g sample in 100ml of solvent ethanol. Then it is subjected to centrifuge at 3000rpm for about 15minutes. The supernant was collected. The extraction was used to undergone DPPH (1,1Diphenyl-2-picrylhydrazyl) assay. The free radical DPPH, stable at room temperature is reduced to the presence of antioxidant molecule (Gyoandi, Anita *et al*. 1999). The anti-oxitant activity of the germinated foxtail millet flour germinated at various periods were determined and the antioxidant values of the germinated foxtail millet flours were measured by using DPPH assay. The values are measured by using the formula:

$$\text{Antioxidant activity (\%)} = \frac{A_c - A_t}{A_c - A_s} * 100$$

The germinated foxtail millet which has high antioxidant activity is used for further study.

RESULTS AND DISCUSSION

Effect of soaking on anti-nutritional factors in foxtail millet flour

Antinutrients are natural or synthetic compounds that interfere with the absorption of nutrients. Anti nutrients are one of the key factors which reduce the bioavailability of various components of the cereals, millets and legumes. Wet processing such as soaking and germination tends to reduce the anti-nutrients and increases the solubility of the minerals and thus enhances the bioavailability of minerals in cereals and legumes.

Table 1 Comparison of the anti-nutrients present in germinated foxtail millet flour soaked at various periods dried by sun drying

S. No.	Anti-nutritional factors	Soaking periods (In hours)				
		8	12	16	20	24
1	Saponin	+	+	+	-	-
2	Tannin	+	+	+	+	-
3	Phytic acid	+	+	+	+	-

Table 1 shows the antinutritional factors of germinated foxtail millet flour soaked at 8hrs,12hrs,16hrs,20hrs &24hrs.The results found that the soaking at 24hrs which had less anti-nutritional factors. It was found that the activity of the enzyme and phytase increases with the duration of soaking. Also, it was observed that the the antinutrional factors present in germinated foxtail flour decreased when the period of soaking increased to 24hours . The result coincides with done byBhuvaneswari et al., (2020).

Comparison of the antioxidant activity present in germinated foxtail millet flour germinated at various periods dried by sun drying

Antioxidants are substances that can prevent or slow damage to cells caused by free radicals, unstable molecules that the body produces as a reaction to environmental and other pressures.

Table 2 Comparison of the antioxidant activity present in germinated foxtail millet flour germinated at various periods

S. No.	Germination period	Antioxidant activity
1	24 hrs	78%
2	48 hrs	83%
3	72 hrs	89%
4	96 hrs	94%

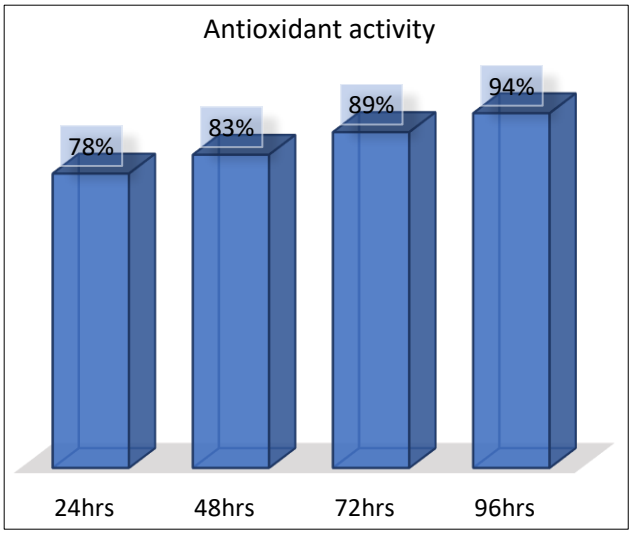

Fig 1 Antioxitant activity of germinated foxtail millet flour germinated at various periods

The data depicted in (Table 2, Fig 1) shows the antioxitant activity of the selected germinated foxtail millet flours dried under sun drying. Among all the germinated foxtail millet flour, the ethanolic extracts of 96hrs germinated foxtail millet flour dried under sun drying showed highest antioxidant activity i.e., 94%. Bhuvaneswari *et al*. (2020) who found that the germinated foxtail millet grains contain more antioxidant activity with extended period of soaking and germination.

CONCLUSION

The study concludedthat the implementation of soaking of 24hours and germination for 96 hrs of foxtail millet flourresulted in reduction of anti-nutritional factors, increase of antioxidant assay and increase of bioavailability. Hence, This is the best method to process the millet and develop value added food products from it. A small step to process the foxtail millet helps to attain food security.

LITERATURE CITED

1. Sharma, N., & Niranjan, K. (2018). Foxtail millet: Properties, processing, health benefits, and uses. Food reviews international, 34(4), 329-363.
2. Ceasar, S. A., Baker, A., &Ignacimuthu, S. (2017). Functional characterization of the PHT1 family transporters of foxtail millet with development of a novel Agrobacterium-mediated transformation procedure. Scientific Reports, 7(1), 14064s
3. Yang, T., Ma, S., Liu, J., Sun, B., & Wang, X. (2022). Influences of four processing methods on main nutritional components of foxtail millet: A review. Grain & Oil Science and Technology.
4. Suma, P. F., & Urooj, A. (2012). Antioxidant activity of extracts from foxtail millet (Setariaitalica). Journal of food science and technology, 49, 500-504.
5. Bhuvaneshwari, G., Nirmalakumari, A., & Kalaiselvi, S. (2020). Impact of soaking, sprouting on antioxidant and anti-nutritional factors in milletgrains. Journal of Phytology, 12, 62-66.
6. Ocheme, O. B., Adedeji, O. E., Lawal, G., & Zakari, U. M. (2015). Effect of germination on functional properties and degree of starch gelatinization of sorghum flour. *Journal of Food Research*, *4*(2), 159.
7. Radhika, G., Sathya, R. M., Ganesan, A., Saroja, R., Vijayalakshmi, P., Sudha, V., & Mohan, V. (2011). Dietary profile of urban adult population in South India in the context of chronic disease epidemiology (CURES–68). *Public health nutrition*, *14*(4), 591-598.
8. Singh, P., & Raghuvanshi, R. S. (2012). Finger millet for food and nutritional security. *African Journal of Food Science*, *6*(4), 77-84.
9. https://www.medicalnewstoday.com/articles/301506#_noHeaderPrefixedContent
10. https://www.sciencedirect.com/topics/food-science/antinutrients