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Assessment of nutritional value of ragi porridge before and after fermentation

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ABSTRACT

The most common food prepared in India using ragi is porridge. It's known that Fermentation has some effects on nutritional qualities of food. Hence in order to ensure that, the nutritional value of ragi porridge before and after fermentation was assessed. Ragi porridge was prepared and was made to ferment. Both the unfermented ragi porridge and fermented ragi porridge was subjected to further analysis. The two samples were checked for the following bio molecule such as carbohydrate, protein, fat, fibre content. The mineral content such as calcium was also checked. From the results it's evident that carbohydrate content of the non-fermented ragi is comparatively lesser than the carbohydrate content of the fermented ragi sample. The result same in case of protein and fibre content too was found to be lesser than fermented sample. But in case of calcium the nutritive value of non fermented sample was found to be higher than that of the fermented sample. Hence it is clearly seen that the nutritive content of the fermented ragi sample is better when compared to the non-fermented ragi sample. Thus fermented millet products are rich in components that promote health such as dietary fibres, proteins, carbohydrates, phenolic compounds etc.

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INTRODUCTION

Compared to major cereal crops, millet is one of the most promising and drought resistant crop. It also exhibits pests and disease resistance, has short growing season and gives a good yield even under drought conditions (Devi *et al.,* 2014) Millet crops are sown as a traditional crop in many parts of the world. Owing to its nutritional value and in terms of productivity, millet grains are gaining importance in both developing and developed countries. (Li *et al.,* 2008). Millets are usually small seeded and have different varieties such as pearl millet, finger millet, Kodo millet, Proso millet, foxtail millet, barnyard millet. The top producer of millet grains in the world was India with an annual production of 334500 tons (43.85%), as compared to the world total production of millet grains which counts to 762712 metric tons. In India millet usually known as Ragi is a traditional crop. People depend on Ragi for their nutritional as well as livelihood security. For the livestock population in water scarce regions of rural India millet becomes an important fodder crop.

In developed countries like North America and European countries even now does not recognise millets as a single important food commodity. But millet as an ingredient in multigrain food is growing value since it is gluten free and also due to the exploration of nutritional value of the grain. People from Asia and Africa take millet as staple food. Varieties of diets such as porridge, bread(fermented and non fermented),beverage are made out of millet and taken especially among the non affluent segment of the population. (Chandrasekara and Shahidi, 2011, 2012). Many

scientific research supports the health benefits of millets. Prolonged use of millet grain decreases the incidence of cardiovascular disease, lowers blood pressure and cholesterol and thus reduces the occurrence of cancer and tumor incidence, delays gastric emptying (Truswell, 2002, Gupta *et al.,* 2012). Millet grains, after harvesting undergoes various steps of processing before consumption. Processing include decorticating, malting, roasting, flaking and grinding. Processing improves the edible, nutritional and sensory properties of the grain. In addition to other health benefits fermented foods also helps prevent dental caries (Neelakantan *et al.,* 2012, Gopinath, 2010). This research has been carried for purpose of assessing nutritional value of millet grains before and after fermentation. Hence in order to ensure that, the nutritional value of ragi porridge before and after fermentation was assessed.

MATERIALS AND METHODS

Fermentation

Ragi porridge was prepared and was made to ferment. Both the unfermented ragi porridge and fermented ragi porridge was subjected to further analysis. The two samples were checked for the following biomolecule such as carbohydrate, protein, fat, fibre content. The mineral content such as calcium was also checked. The energy value in calories was also determined.

Estimation of Nutrient Values of Food

Analysis of Carbohydrate

Total carbohydrate values in the tables are calculated by difference using the following formula for 100 g of food.

$$\text{carbohydrate} = 100\ \text{g} - (\text{g protein} + \text{g fat} + \text{g alcohol} + \text{g ash} + \text{g water}).$$

Carbohydrate calculated in this manner includes dietary fibre, as well as other components of a food that are not protein, fat, alcohol, ash, or water. (Klensin *et al*., 1989).

Determination of Crude Proteins

Protein concentration was estimated by Kjedahl method. Ten grams of the sample was weighed and transferred into a Kjedahl flask.Strong acid is added to the food to digest it.During digestion with strong acid food releases nitrogen. The released nitrogen is estimated by suitable titration. The concentration of the nitrogen determined by titration is used to analyse the concentration of protein in the food.

Determination of Fat/Oil

Ten grams of the ground sample was weighed and transferred into thimbles of a Soxhlet extractor containing 250ml of petroleum ether. The sample was boiled with petroleum ether. Lipids are soluble in organic solvents. Therefore, the lipids in food extract starts dissolving in petroleum ether. The extraction process was continued for 5 to 6 hours. After extraction the solvent was removed and placed in the oven for drying. The weight of the dried and left out sample was recorded. The percentage oil content was calculated as:

$$\%\ \text{crude fat} = \frac{\text{weight of dish + contents after drying} - \text{weight of empty evaporating dish} \times 100}{\text{weight of sample taken for analysis}}.$$

Determination of Fibre content

Two grams of the ground sample was weighed and placed into a conical flask. The sample was extracted by stirring with petroleum ether, to remove fat. After the removal of fat, the sample was boiled with hot sulphuric acid for 40 minutes. It is followed by filtering the extract with fine muslin cloth. The filtrate was washed several times to make sure it is not acidic. Boiling of the extract was repeated with Sodium hydroxide for 40 minutes. The percentage of crude fibre present in the food sample was calculated as,

$$\%\ \text{crude fibre} = \frac{\text{weight of insoluble matter} - \text{weight of ash} \times 100}{\text{weight of sample}}$$

RESULT AND DISCUSSION

Nutritional value of the food which we take is a key factor in maintaining physical and mental health. Nutrition becomes important for the development and maximisation of genetic potential of humans. Food insecurity has been deep rooted in several developing and under developed countries of the world. Solving the problem of malnutrition in these countries are very much essential. Millets stands as a good diet due to its nutritional value and also to the cultivating advantages. (Singh *et al.,* 2012) Nutritional value of millet grain is high when compared to cereal like rice and wheat. (Parameswaran and Sadasivam, 1994). Millets are also rich in essential amino acids and has relatively high concentration of methionine. Millets are also rich in dietary fibre, minerals and antioxidants (Ragaee *et al.,* 2006).

From table 1 it's seen that carbohydrate content of the non-fermented ragi (73.2) is comparatively lesser than the carbohydrate content of the fermented ragi sample (74.5). There was a significant increase in the concentration of protein (8.0) and fibre (3.8) in the fermented ragi sample than the non-fermented ragi sample with the concentrations of protein and fibre being (7.6) and (3.8). But in case of calcium the nutritive value of non fermented sample (43.9) was found to be higher than that of the fermented sample (40.5). Hence it is clearly seen that the nutritive content of the fermented ragi sample was better when compared to the non-fermented ragi sample. The

results obtained from our study clearly depict an increase in nutritive value of ragi which was more than the non-fermented ragi. Almost all the vital nutrients such as carbohydrates, proteins and fibres have quite significantly increased while the fat content remains constant before and after fermentation. This increase in nutritive value of fermented ragi foods makes them healthier than the non-fermented ragi foods. Our results are in line with a similar research done by Ahmed et al (Ahmed *et al.,* 2009), their results also showed an increase in protein and fibre content in fermented ragi than in non-fermented ragi, which helps us prove our result that fermented foods are healthier and have greater nutritional value than non-fermented foods.

Table 1: Nutritive values of ragi

Nutrients	Non-Fermented	Fermented
Carbohydrate (mg/g)	73.2	74.5
Protein (mg/g)	7.6	8.0
Fat (mg/g)	1.5	1.5
Fibre (mg/g)	3.7	3.8
Calcium (mg/g)	43.91	40.5
Calories Kcal/g flour	3.79	3.81

Fermentation is a widely used food preservation technique, in countries like India and Africa. Fermentation helps to preserve food products, improves flavour and enriches the nutritional value of the food products. Thus fermented foods are consumed world wide. (Mugocha *et al.,* 2000). The chemical compositions of millet grains and their food products were found to be modified by fermentation. Therefore, millet grains are used to produce different kinds of traditional fermented foods in developing countries in Africa and Asia. Fermentation is one of the processes that decrease the levels of antinutrients in food grains and increase the protein availability, in vitro protein digestibility.

Fermentation of pearl millet reduced the mineral contents (Na, K, Mg, Cu, Fe, Mn, and Zn) (Neelakantan *et al.,* 2012). Fermentation was also found to cause significant reduction in trypsin and amylase inhibitor activities and the phytic acid content. However, tannin content showed a significant increase after fermentation (Osman, 2011).

CONCLUSION

Based on the results of studies carried out, we can observe that millet grain is rich in bioactive compounds such as dietary fibbers, proteins, and carbohydrates, phenolic compounds. However people choose their diet to show their self esteem. So millet remains to be a food of layman. Awareness should be made regarding the nutritional value and the importance of fermented foods in diet.

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