Effect of Soaking and Germination on Phytic Acid, Inorganic Phosphorous and Proximate Composition of Pigeon Pea (*Cajanus cajan L.*)

Dambar Bahadur Khadka[1] & Dinesh Subedi[2]

[1]Department of Nutrition and Dietetics, Central Campus of Technology, TU, Dharan, [2]Department of Food Technology, Central Campus of Technology, TU, Dharan

Introduction

Pod bearing plant family *Fabaceae* or *Leguminosa*e are commonly known as legumes or pulses.[1] Legumes play an important role in the agriculture and diet of many developing countries and are a major source of dietary nutrients for many people. They resembles 'meat' of the vegetable world[2] and are important sources of proteins and other nutrients in the diet of low income groups of the developing countries[3].

pigeon peas are widely cultivated in all tropical and subtropical regions, with temperature range 20-40^{0}C [4] . Pigeon pea (*Cajanus cajan L.)* is a legume reported to contain 20-28% protein, 1.2 % fat, 65% carbohydrate and 3.8% minerals[5]. they are good sources of protein along with minerals and vitamins[6]. In addition, they also contain antinutritional factors such as polyphenols,phytic acid, saponin, tanninsors, oligosaccharides, saponins and alkaloids, oxalates and trypsin inhibitors, which interfere digestion, absorption and proper utilization of nutrients. The utilization of pigeon pea for human nutrition is also constrained due to these inherent anti-nutritional factors.[7] Among the naturally presented antinutrients, phytic acid that also bind naturally presented phosphorous, is one of the more pronounced anti-nutrintional factor limiting the nutritional quality of pigeon pea .

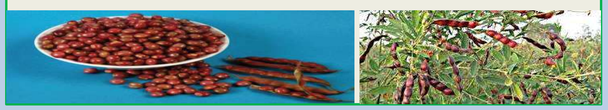
Some simple and inexpensive domestic processing techniques, such as soaking, germination and cooking, are commonly employed to reduce the phytate levels[8] Reduction of the phytic acid by general method at household level will enhance the supply of the nutrients to some extent, however often affect, negatively, the nature and/or on the nutritional value of raw legume grains. It lead the challenge to improve pre-processing modification, that can be apply at household level for effective reduction of phytic acid and optimum utilization of such a important legumes like pigeon pea.

Objective

The general objective of the study is to characterize the effect of soaking in three different (acidic, neutral and basic) conditions and subsequent germination on the phytic acid content of pigeon pea, inorganic phosphorous and its proximate composition, with emphasis on its practicability at the household level.

Acknowledgements

We would like to acknowledge Department of Nutrition & Dietetics and Department of Food Technology, Central Campus of Technology for providing laboratory facilities and all the colleagues and staffs for their kind supports



Materials and Methods

Seed Collection and sample preparation

Matured, dry and brown varieties of pigeon pea seeds were purchased from Chatara, Sunsari. Seeds were cleaned of dust and sorted to remove foreign matters, cracked and damaged seeds. The sound seeds (100 seed mass : 10.01 ± 2.35) samples of about 3 kg each were mixed uniformly to obtain a representative lot for the legume. It was then kept in air tight container and stored at 5^{0}C.

Experiment design

Seed samples were subjected to soaking for 24 hr in three different condition and subsequently allowed to germination for four days (Fig. 1). All experiments were carried out in triplicates. All chemical analysis of each constituents were done in two replicates of the same sample.

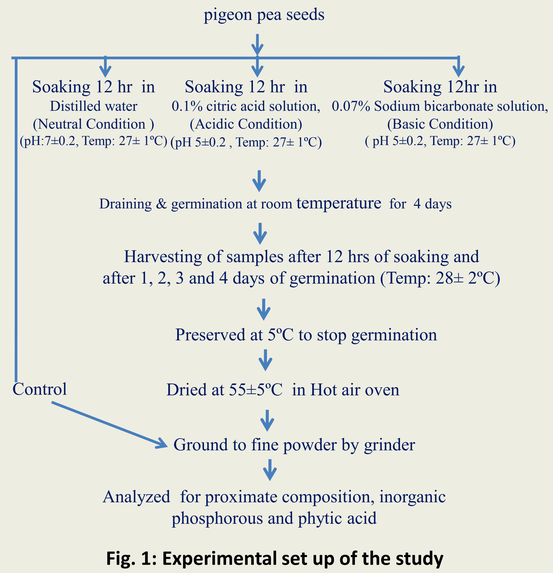


Fig. 1: Experimental set up of the study

Analytical methods

- Powered samples were analyzed for proximate composition according to methods described in Rangana (2009)[9]
- Inorganic phosphorous the method of Fiske and Subbarow (1925).[10]
- Phytic acid was determined by the method of and Davies and Reid (1979).[11]
- All the chemical analyses were done in wet basis and the results were presented in dry basis.

Statistical Analysis

- .Data were subjected to analysis of variance at 95% confidence level using statistical software GenStat Release 12.1 (Discovery Edition 12 developed by VSN International limited).
- Fisher's least significant differences (LSD) test was used to define differences between means at the 5% significance level ($p < 0.05$)

Results

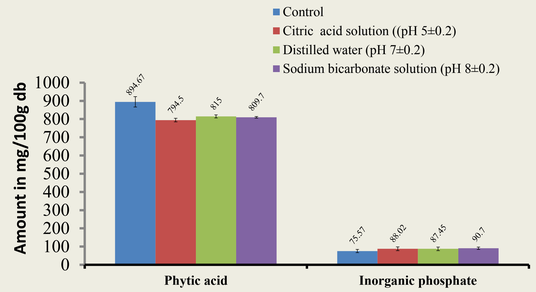


Fig 2: Effect of soaking under different condition on phytic acid and inorganic phosphorous content of pigeon pea

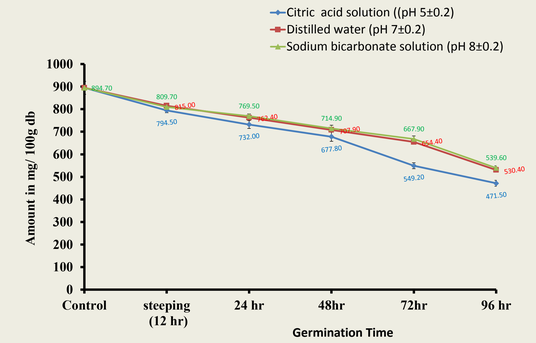


Fig. 3 : Changes in phytic acid content of pigeon pea in relation to soaking conditions and germination time

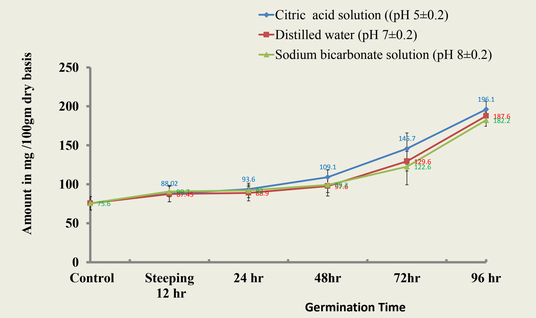


Fig 4: Changes in inorganic phosphorous content of pigeon pea seeds in relation to soaking conditions and germination time

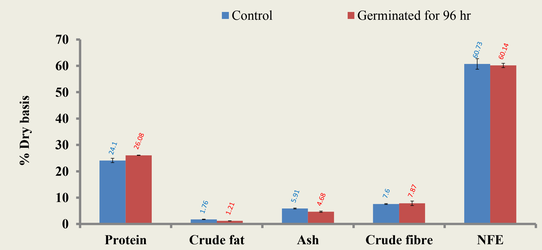


Fig.5: Effect of soaking in acidic condition and subsequent germination on proximate composition of pigeon pea seeds

Results

- Soaking for 12 hrs at room temperature (27±1^{0}C) under different pH condition (5±0.2, 7 and 8±0.2) significantly lowered ($p < 0.05$) the phytic acid content (894.7 mg/100 g) of pigeon pea by 7.99%, 6.38% and 7.20% respectively.
- Subsequent germination of seeds for 96 hrs after 12 hr soaking in acidic, neutral and basic solution further lower significantly ($P<0.05$) the phytic acid content by 47.35, 40.57 and 39.75% respectively and also increased the inorganic phosphorous content (75.6 mg/100 g) by 169.97%, 148.28%, 141.14% respectively.

Conclusions

- Soaking of pigeon pea seeds in acidic condition contribute more effective lowering of phytic acid and corresponding increment of phytic acid compare to neutral and basic soaking condition.
- Soaking 12 hrs in acidic condition followed by subsequent germination for 96 hrs is effective for further lowering of phytic acid. it also enhance the phosphorous level and protein content of pigeon pea seed.
- Slight modification on normal soaking condition in household level (i.e to acidic condition) enhance the better nutrient utilization and subsequent germination will add further advantages on nutritional quality.

References

[1]Belitz, HD, Grosch, W. and Schieberele, P. Legumes. *In:* "Food Chemistry". (H. D. Belitz, W. Grosch and P. Schieberle, Eds.). p. 746. Germany. Springer Verlag 2009

[2]Parpia, HAB. "People and Food Tomorrow". Applied Science Publishers Ltd. London. 1976.

[3]Swaminathan, M "Food science, Chemistry and Experimental Foods" (2nd ed.). The Banglore Printing & Publishing Co. Ltd. No. 88. Mysore Road, Banglore. . 1987.

[4]Sharma P, Patil D. and Patil A. *Crataeva tapia* Linn.-an important medicinal plant; a review of its traditional uses, phytochemistry and pharmacological properties. *Int. J. Pharm. Sci. Res.* 2013. 4 (2), 582-589.

[5]Elhardallou SB. and Walker AF. Phytic acid content of three legumes in the raw, cooked and fibre forms. *Phytochemical Anal*. 1994. 5, 243-246.

[6]Sebastiá VR, Barbera RF and Lagarda M.J. Effects of legume processing on calcium, iron and zinc contents and dialysabilities. *J. Sci. Food Agri*. 2001. 81, 1180-1185.

[7]Savage GP and Deo S. The nutritional value of peas (*Pisum sativum*); A literature review. *Nutr. Abst. Rev.* . 1989. 59, 66-83.

[8]Prodanor M, Sierra I and Vidal-Valverde C. Influence of soaking and cooking on the thiamin, riboflavin and niacin contents of legumes. *Food Chemistry*. 2004. 84, 271-277.

[9]Ranganna S. "Handbook of Analysis and Quality Control for Fruit and Vegetable Products" (2 ed.). Tata McGraw-Hill Pu. New Delhi. 2007.

[10]Fiske CH and Subbarow Y J. The colorimetric determination of phosphorus. Biol. Chem., 1925. 66, 375-400

[11]Davies NT. and Reid H. An evaluation of the phytate, zinc, copper, iron and manganese contents of, and zn availability from, soya-based textured-vegetable-protein meat-substitutes or meat-extenders. *Brit. J. Nutr*. 979. 41, 579-89

Contact

Dambar B. Khadka
Department of Nutrition & Dietetics
Central Campus of Technology, Tribhuvan University
Dharan, Nepal
khadkadambarb@gmail.com