Effect of thermal processing on phytic acid, inorganic phosphorous and proximate composition of pigeon pea

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Background

- Pigeon pea (*Cajanus cajan)* plays an important role in food security, nutrition and balanced diet; can be used in diverse ways as a source of food, feed and fodder
- Presence of phytic acid is one of the main drawbacks limiting its nutritional quality *(Savage and Deo, 1989)*
- Phytic acid accounts for about 60-90% of the total phosphorus in most legumes *(Loewus, 2002).*
- Because of its complex nature and its interaction with proteins and minerals, it is becoming increasingly important from nutrition point of view
- Dietary phytate is often high in developing countries *(Sirelkhatim et al., 1994)*

Contd..

- Pigeon pea seeds also have appreciable amount of phytates which adversely affect bio-availability of certain vital nutrients *(Fasoyiro et al., 2005; Oloyo, 2004)*
- Some simple and inexpensive domestic processing techniques, are commonly employed to reduce the phytate levels
- Processing, however, often affect, negatively, the nature and/or concentration of many nutrients.
- Since the discovery of the negative effects of processing on the nutritional value of raw legume grains,
- The challenge is to determine the appropriate level of processing for optimum utilization

Objectives

This study was undertaken to investigate the effect of thermal processing on phytic acid and inorganic phosphorous along with the effect of these processing on proximate composition of pigeon pea seeds

Significance of the study

- Diet containing high phytate
  - impairs important mineral absorption
  - reduces the phosphorous bioavailability
- Reducing phytate on diet has dual benefits
  - enhanced mineral absorption
  - improved phosphorous utilization
- Hence, study on the influence of local food processing methods with regards to phytate destruction is noteworthy

Methodology

Materials

Matured, dry and brown varieties of pigeon pea seeds used for this research work were purchased from Chatara, Sunsari.

Experimental methods

Pigeon pea seeds

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- **Control** (without treatment)
- **Moist heating**
  - **Open/atmospheric cooking** (30 min in a beaker)
  - **Pressure cooking** (15 min in a pressure cooker)
- **Dry heating**

  microwave roasting at 200±5°C for 5 min

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Preparation of processed samples

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Analysis

Analytical methods

Parameters	Method/Reference
Moisture content, Crude protein, Crude fat, Ash content, Crude fibre, Nitrogen free extract, Total phosphorous	Ranganna (2007)
Inorganic phosphorous	Fiske and Subbarow (1925)
Phytic acid	Wheeler and Ferrel (1971)
Statistical analysis	GenStat Release 12.1

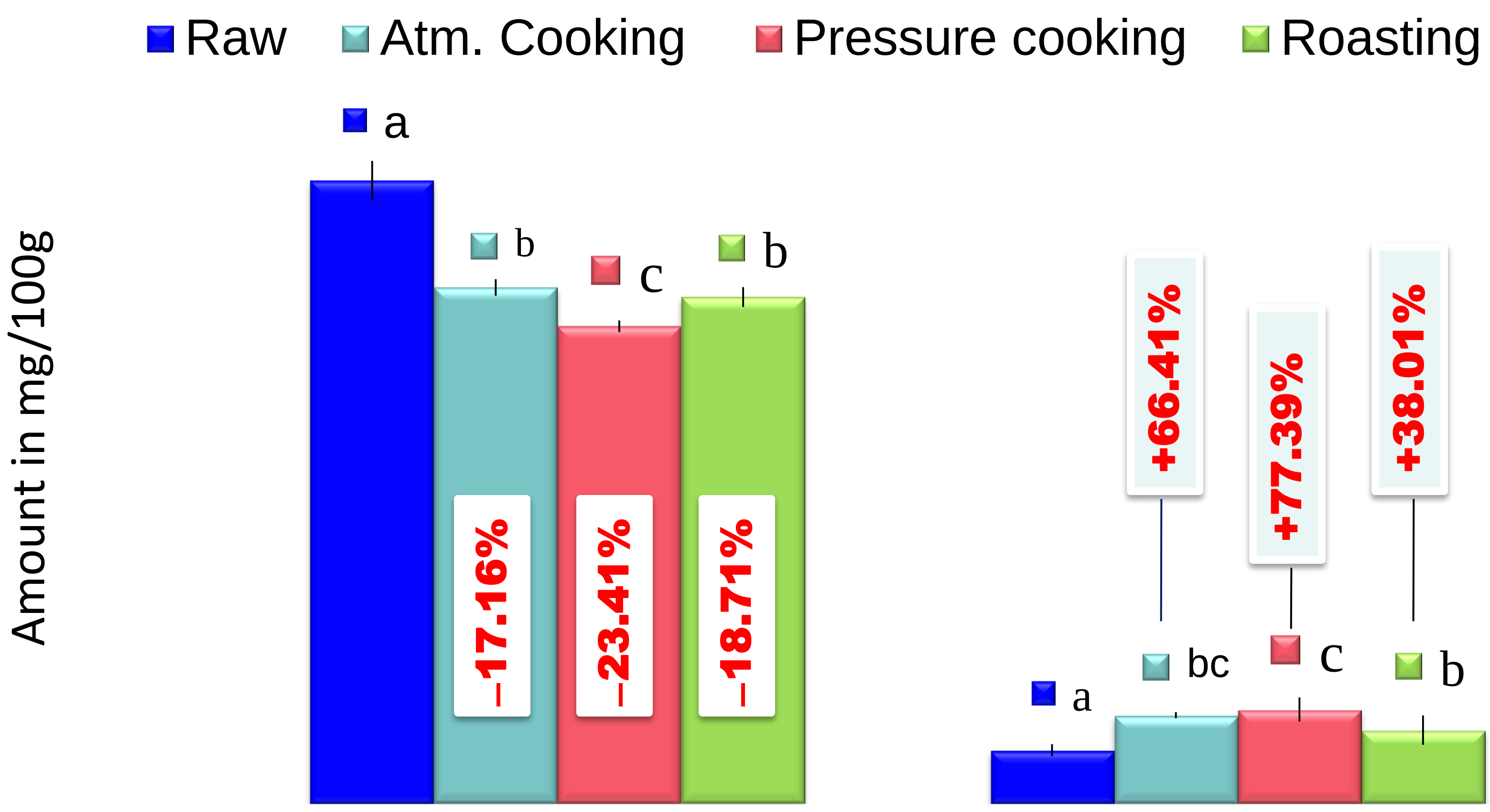
Results

Phytic acid, inorganic phosphorous and total phosphorous of the analyzed pigeon pea variety (mg/100g dry matter)

Parameter	Value
Phytic acid	894.67±28.18
Inorganic phosphorous	75.57±8.54
Phytate phosphorous	252.29±7.95
Total Phosphorous	337.83±12.13
Phytate-P/total-P/ 100g	74.69±1.19

Values presented are the average of triplicate determination

Impact of different heat treatment methods on phytic acid and inorganic phosphorous content of pigeon pea



Bars having similar alphabets are not significantly different at $P < 0.05$.

Effect of heat processing on proximate composition of pigeon pea (g/100g DM)

Parameters / Treatments	Crude protein	Crude fat	Ash	Crude fibre	Moisture	NFE
Raw	24.1	1.76	5.91	7.6	12.67	60.73
Roasting	22.2	1.77	4.9	6.7	5.44	64.48
Atm. cooking	20.9	1.65	4.7	6.9	14.12	65.80
Pressure cooking	20.6	1.49	4.62	6.54	13.97	66.73
LSD at 0.05	0.984	0.1743	0.3348	0.731	0.5129	2.152

Values presented are the average of triplicate determination

Effect of heat processing on proximate composition of pigeon pea (g/100g DM)

Parameters / Treatments	Crude protein	Crude fat	Ash	Crude fibre	NFE
Raw/control	24.1	1.76	5.91	7.6	60.73
Roasting	22.2 **(- 8.1)**	1.77	4.9 **(-17.09)**	6.7	64.48 **(+6.19)**
Atm. cooking	20.9 **(-13.40)**	1.65	4.7 **(-20.47)**	6.9	65.80 **(+8.49)**
Pressure cooking	20.6 **(-14.43)**	1.49 **(-15.34)**	4.62 **(-21.82)**	6.54 **(-13.94)**	66.73 **(+9.89)**

values in the parenthesis are percentage change from that of control.

Conclusions

- Both dry and wet heating significantly reduce the phytate level
- Most of the nutritional components factors were not reduced/changed to a reasonably low
- Reduction of phytate by heat treatments far exceeds the reduction of the nutritional components
- Heat processing treatments could be one the best option that can be performed in household level

References

Fasoyiro, S. B. *et. al.* (2005). Physical characteristics and effects of processing methods on pigeon pea varieties. *J. Food, Agri. and Environ.* ***3 (4), 59-61.***

Fiske, C. H. and Subbarow, Y. (1925). *J. Biol. Chem.* ***66 (325).***

Oloyo, R. A. (2004). Chemical and nutritional quality changes in germinating seeds of *Cajanus cajan L*. *Food Chem.* ***85, 497-502.***

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

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

Sirelkhatim, B., Elhardallou and F., W. A. (1994). Phytic Acid Content of Three Legumes in the Raw, Cooked and Fibre Forms. *Phytochemical Analysis*

Wheeler, E. L. and Ferrel, R. E. (1971). A method for the determination of phytic acid in wheat and wheat fractions. *Cereal Chem.* ***48, 313-320***

Acknowledgement

Central Department of Food Technology

Central Campus of Technology

Prof. Dhan Bd. Karki (PhD.)

Dambar Bd. Khadka

Prabhat Ghimire

Tulasi Shrestha

Thank you !