Physico-Chemical Properties of *papad* from Field Pea Cultivar

Meenakshi Garg[1], Prabhjot Kaur Sabharwal[2]

[1]Bhaskaracharya College of Applied Science, Univesity of Delhi, Sector-2, Phase 1, Dwarka, New Delhi- 110075 India

[2]Indian Institute of Technology, Hauz Khas, New Delhi-110001, India

Abstract: ***A new dimension in the management of protein energy malnutrition is amylase rich foods. The present study was carried out to develop papad using amylase rich fieldpea and to study the effect of processing on nutritional quality by analyzing proximate nutrients, total minerals, and antinutrients using standard methods. All the values are average triplicate values. The preparation of amylase rich flour from fieldpea was carried out after soaking, germination, drying, dehulling and finally grinding it to fine powder. Papad was prepared using roasting processing treatment. Moisture content of fieldpea papad (8.10%) was significantly (P<0.05) lower than the unprocessed mixture (10.01%). Results indicated that there were non-significant differences in crude protein, crude fat and total ash content of unprocessed mixture as well as processed fieldpea papad. The crude fibre content of unprocessed (raw) mixture was 4.14% whereas processed papad contain 3.4% crude fibre. The carbohydrate content of unprocessed and processed papad differed significantly (P<0.05). In unprocessed mixture and processed papad 125.64 and 114.39 mg/100g of Ca content was present respectively. Processing showed significant (P<0.05) effect on iron content of papad. In the unprocessed mixture 3.41 mg/100g Zn was present while after processing 3.28 mg/100g Zn was present. Total soluble sugar of fieldpea papad (6.87%) differed significantly (P<0.05) from its unprocessed mixture (6.03%). The processing treatment significantly (P<0.05) reduced the level of phytic acid, polyphenols and Trypsin inhibitor activity. Thus fieldpea papad can be easily used as a healthy snack. Also because of the low cost it could be easily incorporated in the daily diet.***

Keywords: field pea, papad, and physical, chemical, nutritional

1. Introduction

India is the largest producer of pulses in the world with an annual production of about 12 million tones. Pigeonpea, chickpea, mungbean and uradbean are the main pulse crops grown and consumed in India [1]. Chickpea is unique because of the variety of food products that are prepared from it. The proximate composition of peas is similar to that of chickpea. Fieldpea (*Piscum sativum)* rank first among pulses in yielding ability in India. Hence, it is critical to introduce new foods like fieldpea that have high nutritional quality and are suitable to the environment where a large portion of the persons affected by a food shortage reside. In spite of high protein content, these have not been widely applied in geriatric, pregnant and lactating women and infant nutrition due to high viscosity and presence of antinutrients. Legume seeds contribute substantially to the protein content of the diets of a large part of the world's population, especially in those regions where animal protein consumption is relatively small due to its scarcity or due to cultural taboos. In India chickpea is the principal pulse crop and is consumed in almost all the northern and central states. Unfortunately, consumption of chickpea is not as high as it would be desirable due to their relative scarcity and high market price. The per capita availability of pulses could be increased to some extent through effective utilization of underutilized pulses like fieldpea. So attempt was made to incorporate fieldpea in various food products generally consumed in India. For product development germinated grains as well as amylase rich flour were used.

2. Materials and Methods

2.1 Materials

Jayati variety of fieldpea was procured in a single lot from the Forage Section of Department of Plant Breeding, College of Agriculture, Chaudhary Charan Singh Haryan Agriculture University, Hisar. The seeds were cleaned of dust. Cracked and broken seeds and other foreign material were handpicked. Raw seeds were ground in electric grinder.

2.2 Preparation of amylase rich flour

Seeds were soaked in distilled water [seed: water :: 1: 4(w/v)] for 12 hours at 30°C in an incubator. The soaked seeds were washed and rinsed with distilled water. The steeped grains were spread uniformly on filter paper sheets lined in metal trays. The filter paper sheets were soaked with distilled water and germinated in a BOD incubator maintained at 25°C upto 72 hours. Water was sprayed periodically during germination. Samples were withdrawn at 24, 48 and 72 hour of germination and dried in hot air oven maintained at 55°C to a constant weight. The seed coat and rootlets were detached by gentle abrasion and separated from the endosperm splits. The germinated splits thus obtained were powdered in an electric grinder using 0.5 mm sieve size, represented in figure 1.

Took whole pulse
⇩
Added 3-4 volumes of water
⇩
Kept overnight
⇩
Drained excess water
⇩
Germinated in dark
⇩
Oven dried at 55°C
⇩
Removed rootlets and husk
⇩
Powdered

Figure 1: Flow chart for the preparation of amylase rich flour

2.3 Development of *papad*

Table 1 provides the list of ingredients required in the process of *papad* making. All the dry ingredients are mixed to flour. Hard dough is kneaded using lukewarm water. Mustard oil is used while kneading so that dough does not stick to hands. The dough is proofed fro half an hour and then divided into small balls of 25-30g and rolled on circular plate having smooth surface with a wooden roller to give disc of about 0.6 to 0.8mm thickness and 150-200 cm diameter. Lastly, papad is kept for sun drying.

Table 1: Ingredients for fieldpea *papad*

Ingredients	Fieldpea *papad*
Amylase rich fieldpea flour	60
Black gram dhal flour (g)	30
Black pepper (g) (Coarsely ground)	5
Sodium carbonate (g)	5.5
Cumin seeds	2.5
Salt (g)	7
Mustard oil (g)	2
Water (ml) (lukewarm)	30

2.4 Proximate Composition

The legume sample was estimated for their moisture, crude protein, crude fat, total ash content by employing standard methods of analysis[2]and crude fibre [3].Total minerals were determined by Atomic Absorption Spectrophotometer 2380, Perkin-Elmer (USA) according to the method of Lindsey and Norwell [4] whereas carbohydrate profile was evaluated using ferricyanide method of Hulme and Narain [5]. The starch from sugar free pellet was determined by the method of Clegg [6]. Studies were conducted in triplicate.

2.5 Antinutritional Factors

The methods used were based on Haug and Lantzsch [7] for phytic acid, Singh and Jambunathan [8] for total polyphenols and modified method of Roy and Rao [9] to assess Trypsin inhibitor activity.

2.6 Effect of processing methods

The effect of processing on nutritional evaluation of processed and unprocessed *papad* was studied after obtaining data on nutritional evaluation for the same parameter mentioned previously.

2.7 Shelf life, sensory and chemical evaluation

Samples were drawn at 7 days interval and analysed for sensory quality using 9-point hedonic scale by a panel of 10 judges drawn from Foods and Nutrition Department, CCS Haryana Agricultural University, Hisar.

2.7.1Chemical analysis

The *papad* was analysed for change in moisture [3], peroxide value [10] using the below formula

$$\text{Peroxide value (meq/kg sample)} = \frac{S \cdot N \cdot 1000}{g\ of\ sample}$$

Where, S = ml sodium thiosulphate (blank corrected) N = Normality of sodium thiosulphate solution

Fat acidity was determined using 10g sample extracted with petroleum ether and further titrated with standard KOH [10]. Fat acidity was reported as mg KOH required to neutralize free fatty acids from 100g mixture.

Fat acidity = 10 x (titrated blank – blank value)

The free fatty acids estimated were in accordance with AOCS [11]. Extracted lipid in presence of phenolphthalein was titrated against 0.25 N NaOH to pink color end point which persisted for 30 seconds.

$$\%\ FFA = \frac{ml \cdot N \cdot F \cdot 100}{Sample\ wt. \cdot 1000}$$

Where, ml = ml of NaOH required

N = Normality of NaOH solution F = Equivalent weight (282) of oleic acid

2.8 Statistical analysis

The data were subjected to statistical analysis for "t "analysis of variance and correlation coefficients as per standard methods [12]. ANOVA was used for testing the difference among more than two sample means.

3. Results and Discussion

3.1 Proximate Composition

Table 2: Effect of processing on proximate composition of fieldpea *papad* (g/100g, on dry matter basis)

Fieldpea Papad	*Moisture*	*Crude Protein*	*Crude fat*	*Total ash*
Unprocessed Mixture	10.01±0.12	20.56±0.34	5.19±0.11	3.51±0.29
Processed	8.10±0.06	20.64±0.08	5.12±0.07	3.40±0.23
T cal	14.79*	NS	NS	NS

Moisture content of papad was significantly ($P<0.05$) less than their unprocessed mixture. The decrease in moisture content was due to kilning of roots and oven drying before preparation of amylase rich flour of fieldpea. Saxena *et al.* [13] reported 12.80 to 13.50 percent moisture on *papads* supplemented with different legumes which is higher than the present value. Similar findings are seen in crude protein. Due to addition of black gram flour or due to the cumulative effect of soaking, germination and roasting during preparation of papad, a non-significant difference is found in the fat content of unprocessed mixture as well as processed mixture. Several workers observed higher values of ash content. Saxena *et al*. [13] reported 8.2 to 9.9 percent ash content whereas Bharathi *et al*. [14] reported 9.20 percent ash in *papads* prepared from blends of different pulses. The crude fibre of unprocessed (raw) mixture was 4.14 percent whereas processed *papad* contained 3.40 percent crude fibre. The unprocessed mixture and processed *papad* differed significantly in their fibre content. The decrease in crude fibre content maybe attributed to the dehulling of pulses prior to their conversions into flour. The carbohydrate content of unprocessed mixture was 56.58 percent and processed *papad* had 59.34 percent carbohydrate. Bhartathi *et al.* [14] also reported 58 percent carbohydrate in cowpea *papad.*

Table 2: Effect of processing on different minerals prepared from amylase rich fieldpea (mg/100g, on dry matter basis)

Fieldpea papad	Total calcium	Total iron	Total zinc
Unprocessed mixture	125.64±0.37	4.52±0.02	3.41±0.01
Processed	114.39±0.41	4.30±0.03	3.28±0.01
t cal	20.48*	6.71*	7.93*

The loss observed (table 2) in total calcium, iron and zinc content of *papad* may be attributed to loss of minerals during soaking [15] and decortication [16]. Similar loses have been reported by earlier workers in peas [17].

3.2 Antinutritional Factors

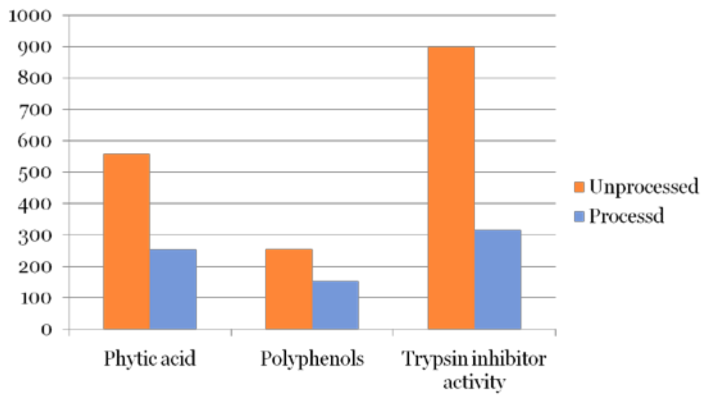

Figure 2: Phytic acid (mg/100g), polyphenols (mg/100g) and Trypsin inhibitor activity (TIU/g) in unprocessed mixture and processed *papad* prepared from amylase rich field pea. A significant (P<0.05) difference was observed in phytic acid content of processed and unprocessed papad. Decrease in phytic acid was mainly due to leaching of phytate ions in soaking and increae in phytase activity during germination. Roasting also decreaed the phyic acid content.

The amount of polyphenols decresed from 256.40 mg/100g (unprocessed mixture) to 153.85mg/100g (in processed *papad*). Maximum amount of polyphenols are present in seed coat. On soaking, germination and dehulling polyphenols are reduced.

A significant dercrease of 64.69 percent in TIA was observed. Cumulative effect of soaking, germination and roasting reduced the TIA. It might be due to breakdown and utilization of trypsin inhibitors during germination and due to themolabile nature of trypsin inhibitor.

3.2 Shelf life evaluation

Table 3: Effect of storage period on sensory quality of *papad* prepared from amylase rich fieldpea

Food product	Storage period at 37±2°C	Sensory parameters					
		Color	Appearance	Aroma	Texture	Taste	Overall acceptability
Fieldpea *papad*	0	7.10ᵃ±0.10	7.10ᵃ±0.10	7.10ᵃ±0.10	7.10ᵃ±0.10	7.40ᵃ±0.16	7.16±0.07
	7	7.00ᵃ±0.00	7.00ᵃ±0.00	6.90ᵃᵇ±0.10	7.10ᵃ±0.10	7.20ᵃᵇ±0.16	7.04±0.02
	14	7.00ᵃ±0.00	7.00ᵃ±0.00	6.80ᵃᵇ±0.13	7.00ᵃ±0.00	7.00ᵇ±0.00	6.96±0.02
	21	6.90ᵃ±0.10	7.00ᵃ±0.00	6.70ᵇ±0.15	7.00ᵃ±0.00	6.90ᵇ±0.10	6.90±0.06
Mean		7.00±0.08	7.02±0.05	6.87±0.17	7.05±0.05	7.12±0.22	7.01±0.11
CD (P<0.05)		0.20	0.17	0.35	0.20	0.33	0.15

Results of the sensory score card of *papad* are depicted in Table 3. Color scores of *papad* revealed that this product was 'liked moderately' at 0, 7, 14 days interval. After 21 days of storage, color decreased and fell in 'liked slightly' category. No overall effect of storage period was observed on appearance and texture of papad. Significant (P<0.05) decrease in aroma was observed on storage of three weeks as compared to fresh papad. For first 14 days taste of *papad* was 'liked moderately/. However after three weeks of storage, a slight decrease in taste was noted and the decrease in test score was differed significantly (P<0.05) at 14 and 21 days interval as compared to fresh and 7 days stored *papad.* Overall acceptability of various sensory parameters of *papad* at 0, 7 days was 'liked moderately' after 14 and 21 days of storage significant (P<0.05) decrease in acceptability was observed. It can be concluded that *papad* was an acceptable product in terms of sensory evaluation.

Table 4: Effect of storage on moisture (g/100g), peroxide value (meq/kg), fat acidity (mg KOH/100g) and free fatty acids (mg/100g fat as oleic acid) on *papad*

Parameters	0	7	14	21	Mean	CD (P<0.05)
Moisture	$8.10^{a}\pm0.05$	$8.10^{a}\pm0.02$	$8.15^{a}\pm0.08$	$8.25^{a}\pm0.02$	8.15	0.18
Peroxide value	$0.27^{a}\pm0.01$	$0.29^{a}\pm0.02$	$0.33^{b}\pm0.01$	$0.41^{c}\pm0.01$	0.32	0.02
Fat acidity	$36.26^{a}\pm0.27$	$39.11^{b}\pm0.08$	$42.25^{c}\pm0.22$	$45.53^{d}\pm0.23$	40.78	0.70
Free fatty acids	$191.16^{a}\pm0.50$	$201.66^{b}\pm0.42$	$215.20^{c}\pm0.61$	$232.20^{d}\pm0.61$	210.16	1.77

A non-significant (P<0.05) increase in moisture content with increase in storage period of *papad* was noticed. *Papad* had 0.27meq/kg peroxide value at 0 day. After 7, 14 and 21 days, peroxide value was 0.29, 0.33 and 0.41 meq/kg respectively. Peroxide value of *papad* varied significantly (P<0.05) at each storage period. Similarly significant (P<0.05) increase in fat acidity of *papad* at each storage interval was noticed. This could be attributed due to hydrolysis of triglycerides resulting in formation of free fatty acids, which increase fat acidity.

Papad had 191.16, 201.66, 215.20 and 232.20 mg of free fatty acids per 100g at 0,7,14 and 21 days of storage respectively. *Papad* had significantly (P<0.05) higher free fatty acids at 7, 14 and 21 days when compared to that of 0 day. Constant breakdown of triglycerides into free fatty acids might have increased the fatty acid content of *papad*. Similar study [18] was reported in fieldpea porridge whereby, significant (P<0.05) increase in fat acidity was observed with increase in storage period.

4. Conclusion

Fieldpea *papad* is a novel and interesting way of incorporating legume in diet. It can be easily incorporated in the diet and is beneficial especially for the poor group in society which otherwise cannot afford diet rich in protein from conventional resources. Fieldpea *papad* has low cost, minimal processing cost and overall moderate acceptability.

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Author Profile

Dr Meenakshi Garg is an assistant prof. at University of Delhi. She postgraduate from ccshau hisar. She published many scientific papers in national and international journals. Her area of interest is nutrition, drying an d food packaging.

Prabhjot Kaur Sabharwal received B.A.Sc (H) Food Technology from Bhaskaracharya College of Applied Sciences, University of Delhi (D.U.) and M.Sc in Food Science and Technology from Central Food Technology Research Institute (C.F.T.R.I) in the year 2009 and 2011 respectively. She has taught B.Sc (H) Food Science and Technology in University of Delhi as Assistant Professor and currently pursuing her PhD from IIT, Delhi.