CHEMICAL ANALYSIS AND SHELF-LIFE STUDIES OF PAPADS PREPARED FROM LEGUME FLOURS

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ABSTRACT

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The study was conducted in the Laboratories of the Department of Food Technology and Rural Industries, Bangladesh Agricultural University (BAU), Mymensingh to determine the chemical composition, texture and flavour. Papads were prepared from Mungbean, Grasspea (Khasari dal), Black gram (Mashkolai dal) incorporating soya flour. All the ingredients were collected from the local market. Five different types of papads were prepared using 0%, 5%, 10%, 15%, 20% soya flour with pulses and other ingredients. The products were analyzed for proximate composition, chemical analysis and self-life evaluation. The moisture, protein, fat, ash and total carbohydrate content in the dried papads samples were found in the range of 10.10 to 10.33%, 24.13 to 28.03%, 1.06 to 5.35%, 1.53 to 1.97% and 54.55 to 62.95%, respectively. No remarkable changes in moisture content, texture and flavour were observed up to 5 months of storage in ambient condition (27 to 35^{0}C) indicating that the products were shelf-stable up to 5 months.

Key ward: Chemical analysis, shelf-life evaluation, composition of papads

INTRODUCTION

Soybeans(s) (US) or soy bean (UK) a legume, the botanical name of which is *Glycine max* (L.) Merrill. It is a summer annual varying in height from less than a food to more than 6 feet with a growth habit from stiffly erect to prostrate; cultivated varieties (cultivar) may reach a height of 3 feet or more; the seeds (soybeans) are borne in hairy-pods that grow in clusters of three to five with each pod usually containing 2 or 3 or more seeds. Oil and protein rich soybean have now been recognized all over the world as a potential supplementary source of edible oil and nutrition (Kaul and Das, 1986). This can play a vital role in balancing the protein-calorie malnutrition in Bangladesh diet. The oil of soybean contains 85% unsaturated fatty acid and is cholesterol free. The soybean is an excellent source of major nutrients including a good source of vitamins and minerals. Besides producing oil, the seeds of soybean are also used for producing many of the food dishes, confectioneries, baby foods and soybean milk. Soybean seeds contain 43.2% protein, 19.5% fat, 20.9% carbohydrate and a good amount of other nutrients like calcium, phosphorus, iron and vitamins (Gopalan *et al*., 1971). Soybean is used mainly for edible oil. Because of its protein content soybean is used in China in different foods and beverage. In terms of protein production per hectare, soybean has the highest yield (800 kg) at the lowest price and compared with all other vegetable proteins, its amino acid composition is one of the best. Soybean have a content of approximately 40-45% high valued protein and 20-22% high valued oil and can be considered to be a concentrated protein food. Soybean has 3% lecithin which is helpful for brain development. It is also enriched in Ca, P, Vit A, B, C and D (Rahman, 1982). If the beans are cleaned and dried to a moisture content of less than 12%, then these can be stored for a year without any significant loss in quality. In oil and protein bearing crops, oil and protein content has got negative relationship (Lat *et al*., 1973). Soybeans also contain isoflavones, forms of phytoestrogen that are considered by many nutritionists and physicians to be useful in the prevention of cancer, though very controversial and also blamed for many health problems. Isoflavones are phenolic compounds, produced primarily by beans and other legumes, including peanuts and chickpeas (Anonymous, 1995). The protein of soybean is called a complete protein as because it supplies sufficient amount of various kinds of amino acids required for body building and repairing the body tissues. Its food value in heart disease and diabetes is well known. Soybean oil contains Lecithin which is an important constituent of all organs in human body and especially of the nervous tissue, the heart and lever. That is why soybean is a very good food (Krishnamurthy and Shivashankar, 1975). The present study illustrated the chemical analysis and shelf-life studies of papads with a view to determine the chemical composition, texture and flavour.

MATERIALS AND METHODS

The study was conducted in the Laboratories of the Department of Food Technology and Rural Industries, Bangladesh Agricultural University (BAU), Mymensingh. The soybean used in the study was collected from Bangladesh Seed Foundation, Mymensingh.

Soya flour

Soya flour was processed from the straw yellow varieties of soyabeans, free from immature, field damage and black soybeans. Using grain cleaners, the foreign materials were removed. Heavy aspiration removed loose

hulls, weed seeds and other light foreign matter. The clean and fresh soybean seeds were then soaked in water [water contained 0.25-0.5% sodium bicarbonate ($NaHCO_3$)] for several (12-16) hours and heated at 70°C for 10 minutes. The main purpose of using $NaHCO_3$ was to remove the bitterness and anti-nutritional factors. The hulls were then removed and dried the dehulled soybean and grinded in a huller mill. The soya flour was packed in a high-density polythene bags, sealed and stored.

Black gram flour (Mashkoli dhal)

Black gram flour was processed which free from immature and field damage. Using grain cleaner, the foreign materials were removed. The clean and fresh black gram grinded in a huller mill. The black gram flour was packed in a high-density polythene bags, sealed and stored.

Mung flour (Mungbean dhal)

Mungflour (10.1% moisture and 24.5% protein) used in the study was commercial mung flour (Norani Flour Ltd, 277 Tejgaon Industrial Area, Dhaka).

Grasspea flour (Khasari dhal)

Khasari flour was processed from BARI khasari-1 varieties, free from immature and field damage. Using grain cleaner, the foreign materials were removed. The clean and fresh grasspea flour grinded in a huller mill. The grasspea flour was packed in a high-density polythene bags, sealed and stored.

Chemicals, solvents and ingredients

Chemicals and solvents used in the study were of analytical reagent grade and water was glass-distilled unless specified otherwise. Black cumin, cumin, mungbean, grasspea, baking powder, salt and other ingredients were procured from the local market. High-density polythene was used for package and storage of samples. Other ingredients were used from laboratory stocks.

Basic formulation of papads

Five different types of papads were prepared according to the composition given in Table 1.

Table 1. Formulas of papads

Ingredients	Samples				
	S_1 (control)	S_2	S_3	S_4	S_5
Grasspea dhal (Khasari dhal)	50 g	50 g	50 g	40 g	45 g
Mungbean dhal	25 g	25 g	20 g	30 g	20 g
Black gram dhal (Mashkolai dhal)	25 g	20 g	20 g	25 g	15 g
Soya flour	0 g	5 g	10 g	15 g	20 g
Black cumin	0.5 g	0.5 g	0.5 g	0.5 g	0.5 g
Cumin	0.5 g	0.5 g	0.5 g	0.5 g	0.5 g
Black pepper	0.5 g	0.5 g	0.5 g	0.5 g	0.5 g
Baking powder	1.2 g	1.2 g	1.2 g	1.2 g	1.2 g
Mustard oil	12.5 g	12.5 g	12.5 g	12.5 g	12.5 g
Common salt	0.6 g	0.6 g	0.6 g	0.6 g	0.6 g
Water	50 g	50 g	50 g	50 g	50 g

Preparation of papads from soya flour

Papad is an important snack food item prepared from the flour. The preparation involves gelatinisation of the soya flour with minimum quantity of water. The soya flour was mixed with requisite quantity of other ingredients as shown in Table1. All the ingredients were mixed in a mixture to make a dough. After 30 min. resting the dough was divided into balls of about 2-3 cm dia weighing 5-6 gm. These were rolled into thin circular discs of about 1 mm thickness using rolling pin. The papads were dried in drier at 50^0C. The dried papads at this stage contained about 14-15% of moisture. The dried papads were then packed in polythene bags. These dried papads were consumed by deep frying in oil. The final products usually undergo 2-3 times expansion on frying. It is crisp and can be consumed as a side dish. The preparation of soya papads is presented in Figure 1.

Mixing (All the ingredients)
↓
Doughing
↓
Making small round shape dough
↓
Rolling
↓
Drying in the drier (50^0C-1 hr)
↓
Packaging
↓
Frying

Figure 1. Flow chart for production of soya papads

The papads lose their crispness if stored in the presence of moisture. So the dried product has to be stored in closed containers.

Chemical analysis of papads

Processed papad samples were analyzed for moisture content, ash, fat, protein and total carbohydrate. All the determinations were done in triplicate and the results were expressed as the average value.

Moisture content

Moisture content was determined adopting AOAC (1984) method as following:

$$\% \text{ Moisture content} = \frac{\text{Loss in weight}}{\text{Weight of sample}} \times 100$$

Ash

Drying the sample at $l00^0$C and charned over an electric heater. It was then ashed in a Muffle furnace at 550^0C for 24 hrs. It was calculated using the following formula:

$$\% \text{ Ash content} = \frac{AW}{IW} \times 100$$

Where, AW = Weight of ash and IW = Initial weight of` dry matter

Fat

AOAC (1984) method using soxhlet apparatus was used to determined crude fat content of the samples.The percent of crude fat was expressed as follows:

$$\% \text{ Crude fat} = \frac{\text{Weight of dried ether soluble material}}{\text{Weight of sample}} \times 100$$

Protein

Protein content was determined using AOAC (1975) method. Percentage of nitrogen and protein calculated by the following equation:

$$\% \text{ Nitrogen} = \frac{T_S - T_B \times \text{Normally of acid} \times \text{meq. of } N_2}{\text{Weight of sample (in gram)}}$$

Where, T_s = Titre volume of the sample (ml), T_B = Titre volume of Blank (ml), Meq. of N_2 = 0.014 and % Protein = Nitrogen × 5.7

Total carbohydrate

Total carbohydrate content of the samples were determine as total carbohydrate by difference, that is by subtracting the measured protein, fat, ash and moisture from 100 (Pearson, 1976).

Storage studies of papads

The papads along with control sample were stored at ambient temperatures (27^0C to 35^0C) for a period of 6 months. The stored papads were analyzed initially at an interval of 15 days up to one month, then at an interval of 30 days for the rest period. During storage studies the change in moisture content, texture and flavour were observed.

RESULTS AND DISCUSSION

Proximate composition of soya flour, mung flour, mashkalai flour and khasari flour

The moisture, protein, fat, ash and total carbohydrate content of soya flour were 11.54, 40.20, 19.65, 4.56 and 24.05%, respectively (Table 2). These findings are in agreement with those reported by Gopalan *et al*. (1971), Krishna and Geervani (1996), Kawamura (1967) and Wolf (1984). The mung flour contained 10.1% moisture, 24.5% protein, 1.2% fat, 0.8% ash and 63.4% total carbohydrate (Table 2). The moisture, protein, fat, ash and total carbohydrate content of mashkalai flour were 10.9, 24.0, 1.4, 0.9 and 62.8%, respectively (Table 2). The khasari flour contained 10.0% moisture, 28.2% protein, 0.6% fat, 2.3% ash and 58.9% total carbohydrate (Table 2). The little variations observed may be due to the varietal difference, seed quality, agro-ecological condition, fertilizer use, extent of drying, storage conditions, methods of analyses etc.

Table 2. Composition of soya flour, mung flour, mashkalai flour and khasari flour

Components	Soya flour	Mung flour	Mashkalai flour	Khasari flour
Moisture (%)	11.54	10.1	10.9	10.0
Protein (%)	40.20	24.5	24.0	28.2
Fat (%)	19.65	1.2	1.4	0.6
Ash (%)	4.56	0.8	0.9	2.3
Total carbohydrate (%)	24.05	63.4	62.8	58.9

Chemical composition of papad

In the present study 5 different samples of papads were S_1 (control papad), S_2 (50% khasari flour, 25% mung flour, 20% mashkalai flour and 5% soya flour containing papad), S_3 (50% khasari flour, 20% mung flour, 20% mashkalai and 10% soya flour containing papad), S_4 (40% khasari flour, 30% mung flour, 25% mashkalai and 15% soya flour containing papad) and S_5 (45% khasari flour, 20% mung flour, 15% mashkalai and 20% soya flour containing papad).

Moisture content

The moisture content of 5 different papad samples processed with different levels of soya flour, mung flour, khasari flour and mashkalai flour was in the range of 10.10 to 10.33% (Table 3). The result showed in Table 3 that the moisture content gradually decreased due to increase of soya flour. The Table 3 also showed that the moisture content of control papad was higher than those of soya, mung, khasari flour fortified papad.

Table 3. Chemical composition of papads

Papad samples	Moisture (%)	Protein (%)	Fat (%)	Ash (%)	Total carbohydrate (%)
S_1	10.33	24.13	1.06	1.53	62.95
S_2	10.20	25.20	3.50	1.64	59.46
S_3	10.17	26.43	4.35	1.75	57.30
S_4	10.13	27.37	4.70	1.83	55.97
S_5	10.10	28.03	5.35	1.97	54.55

Protein content

The protein content of 5 different papad samples S_1, S_2, S_3, S_4 and S_5 were 24.13, 25.20, 26.43, 27.37 and 28.03%, respectively. The result (Table 3) also shows that the protein content was slightly increased due to increase of soya flour.

Fat content

The fat content of processed soya papad samples S_1, S_2, S_3, S_4 and S_5 were 1.06, 3.50, 4.35, 4.70 and 5.35%, respectively. From Table 3, it is evident that the fat content of soya papad and control papad were different. Fat content was the highest (5.35%) in sample S_5 where 45% khasari flour, 20% mung flour, 15% mashkalai and 20% soya flour and the lowest (1.06%) in sample S_1, which was control sample (50% khasari flour, 25% mung flour, 25% mashkalai containing papad). The fat content increased with the increasing percentage of soya flour in the papad samples.

Ash content

The ash (minerals) content of different papad samples S_1, S_2, S_3, S_4 and S_5 were 1.53, 1.64, 1.75, 1.83 and 1.97% respectively. The maximum ash was found in sample S_5 (S_5 (45% khasari flour, 20% mung flour, 15%

mashkalai and 20% soya flour) and lowest in sample S_1 (control). Increased addition of soya flour in different samples gave increased ash content of samples.

Total carbohydrate content (by difference)

The total carbohydrate content of different samples S_1, S_2, S_3, S_4 and S_5 were 62.95, 59.46, 57.30, 55.97 and 54.55% respectively. From Table 3, it may be noted that the total carbohydrate content of papad (control) was higher than that of soya papad. The variations in the carbohydrate content among papad samples may result from the difference in the level of protein, fat, ash and moisture content.

Storage studies of dried soya papad

The shelf life of the processed papad was studied for a period of 6 months at ambient conditions (room temperature). No remarkable change in moisture content, texture and flavour were observed upto 6 months of storage. After 5 months of storage greater increase in moisture content was noticed. The papad samples became less crisp and also developed rancid flavour. The processed soya fortified papad samples were shelf-stable upto 5 months of storage at ambient conditions. The effects of storage time on physio-chemical properties of soya papad are shown in Table 4.

Table 4. The effects of storage time on physio-chemical properties of soya papad

Period of storage (days)	Papad sample	Observations			Remarks
		Moisture content (%)	Texture	Flavour	
0	S_1	10.33	Crisp	Good	Good
	S_2	10.20			
	S_3	10.17			
	S_4	10.13			
	S_5	10.10			
15	S_1	10.35	Crisp	Good	Good
	S_2	10.21			
	S_3	10.17			
	S_4	10.24			
	S_5	10.16			
30	S_1	10.35	Crisp	Good	Good
	S_2	10.22			
	S_3	10.18			
	S_4	10.15			
	S_5	10.12			
60	S_1	10.36	Crisp	Good	Good
	S_2	10.22			
	S_3	10.20			
	S_4	10.16			
	S_5	10.16			
90	S_1	10.37	Crisp	Good	Good
	S_2	10.21			
	S_3	10.22			
	S_4	10.17			
	S_5	10.15			
120	S_1	10.39	Crisp	Good	Good
	S_2	10.23			
	S_3	10.25			
	S_4	10.18			
	S_5	10.16			
150	S_1	10.40	Crisp	Good	Good
	S_2	10.25			
	S_3	10.27			
	S_4	10.15			
	S_5	10.17			
180	S_1	10.43	Less crisp	Slightly rancid	Freshness declined
	S_2	10.26			
	S_3	10.19			
	S_4	10.20			
	S_5	10.18			

CONCLUSION

Soybean flour was prepared in a Huller mill from dehulled, treated and dried soybean. Similarly mung flour, khasari flour and mashkalai flour was prepared in a Huller mill. The moisture, protein, fat, ash and total carbohydrate content of soya flour were 11.54, 40.20, 19.65, 4.56 and 24.05%, respectively. The mung flour contained 10.1% moisture, 24.5% protein, 1.2% fat, 0.8% ash and 63.4% total carbohydrate. The moisture, protein, fat, ash and total carbohydrate content of mashkalai flour were 10.9, 24.0, 1.4, 0.9 and 62.8%, respectively. The khasari flour contained 10.0% moisture, 28.2% protein, 0.6% fat, 2.3% ash and 58.9% total carbohydrate.

No remarkable change in moisture content, texture and flavour were observed up to 5 months of storage in ambient conditions indicating that the products were shelf-stable up to 5 months.

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