STANDARDIZATION OF BREAD PREPARATION FROM SOY FLOUR

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ABSTRACT

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The study was carried out in the laboratory of the Department of Food Technology and Rural Industries, Bangladesh Agricultural University, Mymensingh during 2005.Breads were prepared from wheat flour incorporating 0%, 5%, 10%, 15% and 20% soy flour in the basic formulation. The baking properties of bread such as loaf volume, weight, specific volume and moisture content were evaluated. The loaves were also analyzed for their composition. It was observed that the bread volume decreased with increasing level of soy flour and the bread weight and moisture content significantly increased with the increasing level of soy flour. The crumb and crust colour of bread were improved by incorporating 10% soy flour in bread formulation. The protein content and other nutrients of bread were increased by addition of soy flour. The analysis of bread containing 10% soy flour showed moisture 34.90%, protein 10.75%, fat 2.91%, ash 1.58%, crude fibre 0.61%, sugar 1.59% and total carbohydrate 45.59% respectively. Sensory attributes were evaluated through a taste-testing panel. The response of the taste panelist was statistically analyzed. The colour, flavour, and overall acceptability of bread containing 10% soy flour give the highest average score value but the texture gives the lowest score value.

Key Words: Baking properties, bread formulation, soy flour,

INTRODUCTION

Soybean [*Glycine max* (L.), Merrill] a self-pollinated crop is one of the most important oil and protein crops of the world (Singh and Mittal, 1970). The soybean is an excellent source of major nutrients including a good source of vitamins and minerals. Instead of producing oil, the seeds of soybean could also be used for producing many food dishes, confectioneries, baby foods, etc. (Singh, 1970). The protein of soybean is called a complete protein, because it supplies adequate amount of different amino acids required for building and repairing the damaged body tissues. It is therefore, a valuable food for nutrition (Krishnamurthy and Shivashankar, 1975).

Malnutrition problem is acute in Bangladesh. Children, youths, pregnant, women and poor people are suffering from various nutrition deficiency diseases such as night blindness, anemia, etc. Soybean seeds contain 40 to 45% protein. So, it has been referred to as “the protein hope of the future”. Soybean can play a vital role in balancing the protein deficiency of our diet. Protein content of soybean is about 2 times of other pulses, 4 times of wheat, 6 times of rice grain, 4 times of egg and 12 times of milk. Soybean has 3% lecithin, which is helpful for brain development. It is also rich in Ca, P and Vitamins A, B, C and D (Rahman, 1982).

In Bangladesh breads are now gaining increasing popularity and are no more limited in usage to higher income groups of the population only. Breads are more amenable to variation in the formulation to meet a wide spectrum of consumer demands with respect to taste and nutritional requirements. High protein soy breads form a popular carrier of nutrition to vulnerable groups like pregnant and nursing mothers, young and school going children (Rajput *et al*. 1988). It may be expected that incorporation of soybean flour in the production of bread enhanced the nutritional quality of bread. The addition of the bread to the daily diet of the people may reduce the malnutrition problem of Bangladesh. At the same time the utilization of soybean increase which may encourage the farmers to grow more soybean. Thus the malnutrition problem may be solved and the country’s poverty may be reduced to a certain level. Keeping the above statement an attempt was undertaken to utilize the soybean for the preparation of bread incorporating various proportion of soy flour and to evaluate their baking quality.

MATERIALS AND METHODS

The study was carried out in the laboratory of the Department of Food Technology and Rural Industries, Bangladesh Agricultural University, Mymensingh.

Raw materials: Commercially available wheat flour (Maida) was procured from local market but good quality of soybean was procured from local market and then thoroughly washed in water. Now it was boiled at 100^0C for 10 minutes adding 0.5% sodium-bicarbonate in order to peel. The peeled soybean was dried at 65^0C for 8 minutes in a cabinet drier. The dried soybean was ground in flour mill into soy flour and then packed in a high-

density polyethylene bags for storage. Wheat flour was added with soy flour and breads were prepared as per following treatments using the recipe describe below:

Treatments:

T_0 = Wheat flour with 0% soy flour (Control)
T_1 = Wheat flour with 5% soy flour
T_2 = Wheat flour with 10% soy flour
T_3 = Wheat flour with 15% soy flour
T_4 = Wheat flour with 20% soy flour

The same amount of i) Sugar, ii) Salt, iii) Fat (dalda), iv) Yeast (active dry yeast) and v) Bread improver (Mixture of potassium bromate 0.3g, ascorbic acid 0.5g, calcium sulphate 7.5g, ammonium chloride 5 g and malt flour 36.7g)

Procedure for preparation of bread

Two hundred parts blended flour with 8 parts sugar, 4 parts salt, 8 parts fat (dalda), 4 parts yeast (active dry yeast) were weighed separately and liquid ingredients 1 part bread improver and required amount of water (125-130ml) were measured by pipette and conical flask. The methods of Kent (1984) were followed in the bread making procedures. At first the yeast was dehydrated in warm (40°C) water (8 ml water/gm of yeast) to ferment for 10 minutes. Sugar and salt were dissolved in remaining calculated quantity of water. All the ingredients were mixed in a mixer machine for about 10 minutes to make control bread and breads from soy flour. The prepared dough was set a side for 2 hrs while fermentation proceeded. The dough was covered with moistened cloth to prevent moisture loss. After 2 hrs dough were "Knocked back" i.e. manipulated to push out the gas that had been involved in order to even out the temperature and give more thorough mixing. After "Knock back" the dough were again rested for about 1 hr. Then the dough divided into loaf size portion (i.e. 200g) and these were roughly shaped. The dough pieces were rested at about 27°C for 10-15 minutes (1st proof) and molded into final shape during which the dough were mechanically worked to tighten it so that the gas and water distributed better, retained and placed in pre greased baking pans. The dough was rested again in the baking pan for the final proofs of 60 minutes at 370°C were then baked in the oven at a temperature of 230°C for 40 min. The loaves were allowed to cool for a minimum of 2 hrs at 24°C before evaluation.

Estimation of moisture: The percent of moisture in the samples were estimated by the standard procedure as recommended by Hall (1970).

Estimation of protein: The percent of protein (N X 5.7) present in the samples were determined by Microkjeldhal method as recommended by the AOAC (1984).

Estimation of ash, crude fibre and total sugar: The percent of ash, crude fibre and total sugar present in the samples were determined by standard procedure as recommended by the AOAC (1984).

Estimation of carbohydrate: The percent of carbohydrate was determined by approximation i.e. by subtracting the measured protein, fat, ash, and moisture from 100 (Bender, 1982).

Evaluation of physical characteristics of bread: Bread volume was initially used as important parameters of bread quality. The bread volume was determined by seed displacement method (Ott, 1987). The volume was measured by subtracting the volume of mustard seed required to fill the empty container from the measured volume of rapeseed required to fill a given container that held the bread for which volume was being determined. The weight and specific volume of baked bread were also measured.

Sensory evaluation of bread: Bread prepared from wheat flour with different levels of soy flour were evaluated by a taste-testing panel judges comprising of teachers, scientific officers, students and employees of the Department of Food Technology and Rural Industries, Bangladesh Agricultural University, Mymensingh as per the method described by Ranganna (1987). The panelists (15) were asked to assign a 9-point hedonic scale for colour, flavour, texture and overall acceptability. The highest score is 9 'like extremely' and 'dislike extremely' is the lowest score of 1. The data were analyzed for ANOVA in completely randomized design (CRD) under computerized statistical methods of M-stat and least significant difference (LSD) was used to compare the means.

RESULTS AND DISCUSSION

Composition of soy flour

The chemical composition of studied soy flour were moisture content 11.80 %, protein 43.50%, fat 20.30%, ash 4.10%, crude fibre 0.90% and total carbohydrate 20.30%. Similar result was also observed by Gopalan *et al.* (1971).

Composition of breads incorporated with soy flour at different levels

Breads were prepared with 0, 5, 10, 15 and 20% soy flour and subsequently proximate compositions of the bread were determined and the results were presented in Table 1.

Table 1 Proximate composition of bread incorporated with soy flour at different levels

Treatments	Moisture (%)	Protein (%)	Fat (%)	Ash (%)	Crude fiber (%)	Total sugar (%)	Carbohy-drate (%)
Wheat flour with 0% soy flour (Control)	35.65^{a}	8.95^{c}	1.80^{c}	0.56^{e}	0.72^{a}	1.87^{a}	53.04^{a}
Wheat flour with 5% soy flour	35.45^{a}	9.16^{c}	2.37^{bc}	0.96^{d}	0.66^{ab}	1.75^{ab}	52.05^{a}
Wheat flour with 10% soy flour	34.90^{ab}	10.75^{b}	2.91^{ab}	1.58^{c}	0.61^{bc}	1.59^{bc}	49.86^{b}
Wheat flour with 15% soy flour	34.35^{bc}	11.15^{b}	3.20^{ab}	1.91^{b}	0.57^{bc}	1.48^{cd}	49.39^{b}
Wheat flour with 20% soy flour	33.95^{c}	12.36^{a}	3.62^{a}	2.24^{a}	0.51^{c}	1.36^{d}	47.83^{c}

Moisture content

The moisture content of five different formulations T_0, T_1, T_2, T_3 and T_4 in Table 1 showed that the highest moisture content was observed in control bread (35.65%). Then the moisture content decreased gradually with the incremental addition of soy flour. This might be due to the fact that soy flour contained higher amount of solid matters compared to wheat flour.

Protein content

The protein content of different bread was found from 8.95 to 12.36% as shown in Table 1. The protein percentage of soy bread gradually increased with increasing level of soy flour. It may be due to the fact that the soy flour contained the higher amount of protein. Thus addition of soy flour to bread might increase the protein content of bread. Kent (1980) reported that wheat bread contained 8.65 to 9.25% protein.

Fat content

The fat content of different bread was observed 1.8 to 3.62% as presented in Table 1. It was found that the fat content of soy bread were more than that of control bread and the fat content increased with the increasing level of soy flour. This is due to the fact that soy flour contained higher percentage of fat than wheat flour. Kawamura (1967) reported that soy flour contained 21% fat whereas wheat flour contains 0.9%.

Ash content

The ash content of different bread was shown 0.56 to 2.24% as shown in Table 1. It was seen that the ash content was the highest in the sample containing 20% soy flour (2.24%) and the lowest in control bread (0.56%). The ash content increased with increasing level of soy flour in the bread samples. Harper *et al.* (1983) reported that wheat bread contained 0.5% to 0.98% ashes.

Crude fibre

The crude fibre content of different bread was given in Table 1. Crude fibre content ranged from 0.51 to 0.72% in the prepared bread and it was decreased with the increase of soy flour. The crude fibre represents variable fraction of dietary fibre and includes mostly the lignin, cellulose and hemicelluloses components. The soy flour may contain higher amount of this type of crude fibre than that of wheat flour. It may be due to the addition of soy flour to the bread formulations. Harper *et al.* (1983) and Srivastava *et al.* (1993) who reported that control bread contained 0.65 to 0.80% crude fibre.

Total sugar

The sugar content of different bread samples was 1.36 to 1.87% as shown in Table 1. The optimum level of sucrose enhanced the flavour of bread but more sugar content give decreased acceptability of bread. Harper *et al.* (1983) and Srivastava *et al.* (1993) reported that control bread contained 1.78 to 1.85% sugars.

Total carbohydrate

The carbohydrate content of different bread samples was 47.83 to 53.04% presented in Table 1. It may be noted that the total carbohydrate content of soy flour free (Control sample) bread was higher (53.04%) than that of soy flour content breads. The variations in carbohydrate content among the bread samples may results from the difference in the level of protein, fat, ash and moisture content of wheat flour and soy flour. Harper *et al.* (1983) and Srivastava *et al*. (1993) reported that control bread contain carbohydrate 54.36 to 55.56%.

Physical properties of soy bread

The breads were prepared from wheat flour with 0, 5, 10, 15 and 20% of soy flour. The physical properties of breads are volume, weight, specific volume and moisture content as presented in Table 2.

Table 2 Effect of various levels of soy flour on volume, weight, specific volume and moisture content of bread

Treatments	Volume (cc)	Weight (g)	Specific volume (cc/g)	Moisture content (%)
Wheat flour with 0% soy flour (Control)	508^{a}	216^{d}	2.36^{a}	35.65^{a}
Wheat flour with 5% soy flour	502^{ab}	218^{c}	2.29^{ab}	35.45^{a}
Wheat flour with 10% soy flour	497^{abc}	219^{ab}	2.28^{ab}	34.90^{ab}
Wheat flour with 15% soy flour	494^{bc}	220^{ab}	2.18^{c}	34.35^{bc}
Wheat flour with 20% soy flour	488^{c}	223^{a}	2.10^{d}	33.95^{c}

Bread volume

The volumes of different bread were as shown in Table 2. It was observed that the volume of control bread gave higher volume than that of all soy flour breads. It was also observed that breads with increasing level of soy flour showed decreasing level of bread volume. It may be due to the effect of gluten quality of flour.

Weight of breads

The weights of different bread were shown in the Table 2. It was observed that the weights of all the breads were higher than that of control bread. It was also noted that with the increasing level of soy flour the bread weights increased. This might be due to the fact that soy flour contained higher amount of solid matters compared to wheat flour.

Specific volume of breads

The specific volumes of different bread were determined and given in Table 2. The result varied from 2.20 to 2.34 cc/gm and specific volume gradually decreased with increasing level of soy flour in bread formulation. This may be due to baking quality of the soy flour i.e. soy flour may be comparatively less baking quality than that of wheat flour.

General appearance, crust and crumb characteristics of soy flour bread

General appearance and crust characteristics

General appearance and crust characteristics of soy flour bread at different level are presented in Table 3. It was observed that control bread and bread containing 10% soy flour had better appearance. The crust colour of breads with 5%, 10%, 15% and 20 % soy flour were similar and brownish while that of control bread was light brown. It may be due to the brownish colour of soy flour.

The texture of the crust applies to the condition of the crust and would vary somewhat of breads containing soy flour. The crispy crust was observed in control bread, slight crispy in soy flour bread with 5 and 10% soy flour and the rests were soft silky. The overall crust characteristics of soy flour bread with 10% soy flour seemed to be better than that of the others.

General appearance and crumb characteristics

General appearance and crumb characteristics of soy flour bread at different level are presented in Table 3. It was observed that the crumb colour of soy flour breads containing 5%, 10%, 15% and 20 % soy flour were brownish whereas the control bread was whitish. So, crumb colours of soy flour breads are not attractive. Control bread and bread containing 5% and 10% soy flour were similar texture. From acute observation it was found that the overall crumb texture of soy flour bread containing 10% soy flour was the best among the samples. A perfect texture should be free from lump and hardness and should present a smooth silky surface. (Srivastava *et al.*, 1993). It was also observed that the air cell size and uniformity might be relatively standard with the differences probably resulting from inexperienced dough handling rather than the effect of the

supplements. A few air cells present in control bread but very little in soy flour breads. The air cell size in control bread was slightly larger than the breads containing soy flour.

Table 3 Crust and crumb characteristics of different level of soy breads

Treatments	General appearance	Crust characteristics		Crumb characteristics				
		Colour	Texture	Colour	Texture	Structure	Air cell present	Air cell size
Wheat flour with 0% soy flour (Control)	Flat smooth	Light brown	Slight crispy	Slight brown	Soft silky	Even	Very few	Slightly larger
Wheat flour with 5% soy flour	Flat smooth	Light brown	Slight crispy	Slight brown	Soft silky	Even	Very few	Small
Wheat flour with 10% soy flour	Flat rough	Brown	Soft silky	Brown	Soft silky	Coarse even	Very few	Small
Wheat flour with 15% soy flour	Flat rough	Brown	Soft silky	Brown	Soft silky	Coarse even	Very few	Small
Wheat flour with 20% soy flour	Flat smooth	Light brown	Crispy	White	Soft silky	Fine even	Few	Larger

Effect of soy flour on sensory quality soy bread

The effect of soy flour on colour, flavour, texture and overall acceptability by the panel judges of soy breads are presented in Table 4. It is apparent from the results of a two-way analysis of variance (ANOVA) that F-values were tabulated at 5% level of significance of all the sensory attributes. The result revealed that there was significant difference in overall acceptability among the bread samples since calculated F-values (4.63) was greater than the tabulated F-values (2.68). This indicated that the overall acceptability of control bread and soy flour supplemented with various levels of soy flour were not equally acceptable. Soy flour bread containing with 20% soy flour had the lowest overall acceptability (6.18). It may be due to the flat rough appearance and soft silky texture and distinct flavour of the flour. On the other hand control bread secured the highest score (7.92) for overall acceptability, whereas soy flour bread containing 10% soy flour had the second highest overall acceptability score (7.41) considering colour and flavour. It's crust has light brown colour, slight crispy texture and it's crumb has slight brown colour, soft silky texture. A very few air cell was present in this soy bread.

Table 4. Effect of soy flour on colour, flavour, texture and overall acceptability of the soy breads by panel judges

Treatments	Mean scores on			
	Colour	Flavour	Texture	Overall acceptability
Wheat flour with 5% soy flour	7.16^{b}	7.43^{a}	7.10^{b}	7.28^{a}
Wheat flour with 10% soy flour	7.34^{a}	7.46^{a}	7.08^{ab}	7.41^{a}
Wheat flour with 15% soy flour	6.76^{b}	7.083^{b}	6.36^{c}	6.28^{b}
Wheat flour with 20% soy flour	6.71^{b}	6.50^{b}	6.28^{c}	6.18^{b}
Wheat flour with 0% soy flour (Control)	8.083^{a}	7.96^{a}	7.61^{a}	7.92^{a}
LSD ($P<0.05$)	0.8395	0.7035	0.6759	0.8598

From the study, it is observed that wheat flour could be substituted for soy flour in the formulation of soy flour breads up to 10% level to achieve bread with acceptable quality attributes. The second highest overall acceptability score achieved by bread with 10% soy flour is expected since it secured the highest score of three quality attributes and the lowest score for one quality attribute. It was also evaluated that the flavour, texture and overall acceptability of bread containing 10% soy flour were more acceptable than other breads incorporated with soy flour.

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