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EVALUATION OF THE NUTRITIONAL AND SENSORY QUALITY OF FUNCTIONAL BREADS PREPARED FROM WHOLE WHEAT AND SOYBEAN FLOUR

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Abstract
The study was designed to use whole wheat and soybean flour blends in the preparation of functional bread to improve the quantity and quality of protein, mineral and fiber content. Soybean flour at levels of 10, 20 and 30% was used in wheat flour for the production of bread while the whole wheat flour bread (sample -1) served as control. The proximate composition of the flour blends used for the preparation of the breads was determined by using standard methods. The protein content in bread increased from 8.0% (100% wheat flour) to 11.0% in composite flour containing 30% soybean flour. Similarly, crude fiber and mineral contents increased from 3.50 to 5.00% and 1.90 to 2.50 % respectively. With progressive inclusion of the soybean flour, the sensory analysis showed that there was no significant difference observed between the whole wheat bread and the soybean enriched bread samples in texture and crumb appearance, While significant difference ($p<0.05$) was observed in crust color, flavor and the mean overall taste acceptance score of bread were 4.50 ± 0.23, 4.75 ± 0.23, 4.25 ± 0.43, 4.00 ± 0.57 respectively. The organoleptic test showed that the substitution of 10% soybean flour into whole wheat flour was more acceptable comparing with all quality characteristics.

Keywords: Soybean flour, wheat flour, functional bread, composite flour, fiber content, protein content, mineral content, proximate composition, sensory analysis, organoleptic test.

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1.0 INTRODUCTION

Bread may be described as a fermented confectionary produced mainly from wheat flour, yeast, water, and salt by a series of process involving mixing, kneading, proofing, shaping and baking (Dewettinck et al., 2008). The consumption of bread and other baked goods such as breads, biscuits, doughnuts and cakes produced from wheat flour is very popular now a days, but the low protein content of wheat flour, which is the most vital ingredient used for the production of different kinds of baked produce has been major concern in its utilization (Young, 2001). However, wheat is a good source of calories and other nutrients but its protein is of poor nutritional quality when compared to milk, soybean and pea proteins as its protein is deficient in essential amino acids such as lysine and threonine (Bakke et al., 2007 and Jideani et al., 2009). The use of wheat flour derived from the processing of whole wheat grain, which is aimed at improving the aesthetic value of wheat bread, has also led to the radical reduction in the nutritional density and fiber content when compared to bread made from whole grain cereals (Maneju et al., 2011). Recently, consumer's awareness of the need to eat superior quality and healthy foods known as functional foods, that is, foods which contain ingredients that provide additional health benefits beyond the basic nutritional requirements, is increasing now a day. Therefore, the tendency is to produce specialty breads made from whole grain flour and other functional ingredients known as health breads or functional foods (Ndife et al., 2006). Consumption of such functional foods not only improves the nutritional status of the general population but also helps those suffering from degenerative diseases associated with today's changing life styles. The whole wheat flour has been shown by many researchers to be a rich source of these functional ingredients such as

fiber, phytochemicals, minerals, essential amino acids that are located in the bran and fat soluble vitamins contained in the germ of the whole wheat grain (Jideani et al., 2009).

The fortification of bread and other cereal based confections with legume flours particularly in regions where protein utilization is inadequate has long been recognized. This is because legume, nutritionally proteins are high. Legumes can be used as a complement cereal when blended at optimum ratio (Okoye et al.,2009). High protein soybean breads form a popular carrier of nutrition to vulnerable groups like pregnant and nursing mothers, young and school children in reducing the incidence of malnutrition and at the same time encourage the farmers to grow more soybeans due to the increased utilization (Islam et al., 2007).

At present soybean is one of the most important oil and protein crops of the world. Soybeans contain 30 to 45% protein with a good source of all essential amino acids. The protein content of soybean is about 2 times of most 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 calcium, phosphorous and Vitamins A, B, and D, it has been referred to as the protein hope of the future. Moreover, isoflavones contained in soybeans are effective cancer-preventive agents for lowering risks of various cancers disease. Evidence also points to the beneficial effects of soybean isoflavones in the prevention of cardiovascular. The high protein content in the soy supplemented breads would be of nutritional importance in most developing countries, such as in Bangladesh, where many people can hardly afford high proteinous foods because of their expensive costs. Therefore there is the need to develop a different approach to offer the weary consumers the opportunity to feed on improved formulations with substantive health benefits from wheat-soybean combinations. A functional food, that combine many nutritional benefits of whole-wheat supplemented with soybeans has been proposed to cater for a set of consumers whose health has been compromised such as those suffering from protein-energy-malnutrition, diabetes and obesity (Gomez et al., 2003). The objectives of this study therefore, were to formulate and develop functional breads from whole wheat flours composited with soybean flour and to evaluate the products nutritional, sensory quality and consumer overall acceptability.

2. MATERIALS AND METHODS

2.1 Place of Experiment

The samples analyses were conducted in the laboratory of Food Technology and Nutritional Science Department, Mawlana Bhashani Science and Technology University, Tangail Bangladesh. Protein and fat tests of different samples were conducted in Institute of Food Science and Technology (IFST), Bangladesh Council of Science and Industrial Research (BCSIR), Dhaka Bangladesh.

2.2 Raw Materials

Refined wheat flour, soybean flour, sugar powder, iodized salt, yeast powder, spice and other general ingredients were procured from the local market.

2.3 Preparation of composite flours:

The composite flour was prepared by using certain proportions of wheat and Soybean flours according to the recipe as shown in table -2.

2.4 Bread making

The whole wheat flour was then mixed, with varying inclusions of 0, 10, 20 and 30 % of the soybean flour. Then the composite flours were blended with other baking ingredients in a mixer, kneaded for 12 min into consistent dough and the resulting dough was molded and placed in a pre-oiled baking bowl. After that the dough was proofed for 45 to 60 min at 35°C and 85% relative humidity and baked in a reel oven for 35 min at 217°C.

2.5 Physico-chemical analysis:

The wheat flour, soybean flour and bread were chemically analyzed to determine moisture

content, protein content, fat content, crude fiber and ash according to AOAC (2002) methods

2.6 Statistical analysis:

The differences between various levels of supplementation in bread were obtained by using statistically analysis according to the methods described by Steel and Torrie (1980) The comparisons were carried out by SPSS programmed.

3. RESULTS AND DISCUSSION

3.1 Chemical composition of raw materials:

The raw materials, i.e., wheat flour and soybean flour were analyzed for proximate composition and the data are presented in Table-1. Wheat flour contained 12.46% moisture, 11.58% protein, 0.58% crude fiber, 1.18% crude fat and 0.85% ash. Owing to the extraction of bran and germ from whole wheat flour, it contains lesser amount of protein, fiber, fat and ash. Soybean flour was richer in crude protein, crude fiber, crude fat and ash as compared to wheat flour. Average protein content in the soybean flour was 39.20%, crude fiber 6.4%, crude fat 10.10% and ash 2.53%.

Table-1: Chemical composition of raw materials

Parameter	Flour sample	
	Soybean flour	Wheat flour
Moisture %	5.50 ± 0.17	12.46 ± 0.13
Protein %	39.20 ±0.12	11.58 ± 0.24
Fiber %	6.40 ±0.14	0.58 ± 0.27
Fat %	10.10 ± 0.06	1.18 ± 0.16
Ash %	2.53 ±0.15	0.85 ± 0.19
Carbohydrate %	36.89 ± 0.15	73.35 ± 0.11

3.2 Nutritional quality assessment:

The results obtained from the physical properties and chemical analyses investigated are shown in Table 3. The increased supplementation of whole wheat flour with soybean flour greatly affected the physico-chemical properties of composite bread. The proximate composition for moisture, ash, fat, crude fiber and protein, were lowest in whole wheat bread (normal), which served as control and higher in other soybean substituted samples.

Table – 2: Recipe for different bread sample.

Ingredients %	Normal (g)	Sample 1 (g)	Sample 2 (g)	Sample 3(g)
Wheat flour	100	90	80	70
Soybean flour	0	10	20	30
salt	2	2	2	2
Sugar powder	6	6	6	6
Fat/ Shortening	4	4	4	4
Yeast powder	2	2	2	2
spice	1	1	1	1
water	65	65	65	65
Total dough weight	180	180	180	180

Table -3: Nutritive values of different bread sample.

Nutrients	Contents per 100gm			
	Normal (g)	Sample 1(g)	Sample 2(g)	Sample -3(g)
Moisture	28.45 ± 0.11	32.00 ± 0.12	35.00 ± 0.13	37.00 ±10
Protein	8.00 ± 0.12	9.50 ± 0.14	10.75 ± 0.17	11.00 ± 0.15
Fat	4.50 ± 15	5.00 ± 0.05	5.15 ± 0.25	5.50 ± 0,18
Ash	1.90 ± 0.12	2.20 ± 0.15	2.35 ± 0.20	2.50 ± 0.15
Crude fiber	3.50 ± 0.16	4.00 ± 0.16	4.50 ± 0.15	5.00 ± 0.16
Carbohydrate	53.60 ±0.14	47.50 ± 0.16	42.25 ± 0.15	39.50 ± 19
Energy (Kcal)	285	275	255	245

The proximate values increased with increasing levels of soybean flour substitutions except for carbohydrate content and energy values which showed the reverse. The carbohydrate content and energy values were highest in normal

(53.60% and 285 Kcal) and lowest in sample-3 (39.50 % and 245 Kcal), respectively.

The moisture contents of the composite breads increased with soybean flour substitution by a range of 32.0 to 37.00%. Increase in moisture content has been associated with increase in fiber content. There was also an increase in the protein content of the composite breads with soy-flour substitution. The protein content in control, sample-1, sample-2 and sample-3 bread was 8.0, 9.5, 10.75 and 11.0% respectively. The fat content also increased from 4.50 in control bread sample to 5.5% in the composite breads produced from soy-bean flour substitution. The crude fiber content of the composite bread also increases with progressive inclusion of soybean flour. In normal it determined 3.5, in sample-2 it was 4.0, in sample-2 it was 4.5 and in ample-3 it was obtained 5.0 percentages as the whole-wheat flour was substituted with soy bean flour. The crude fiber most likely from the bran of the whole wheat flour and the hull of soy beans represents variable fraction of dietary fiber and includes mostly the lignin, cellulose and hemicelluloses components. The increased fiber and the lower carbohydrate content of composite breads have several health benefits, as it will aid in the digestion of the bread in the colon and reduce constipation often associated with bread produced from refined wheat flour.

3.3 Comparison of Organoleptic or Sensory Qualities of Breads:

Organoleptic tests of the bread depend on its first crust color, crumb appearance, texture, flavor and overall test acceptance of the sample. Table-4 shows the comparison among the breads of their organoleptic quality factors. Table-4 shows that normal bread obtained lower score 3.75±0.17 for its crust color. In the crumb appearance acceptability test, Hedonic scale showed that normal bread and sample-1 liked very much (>4) by the Judge. Normal breads without incorporation of Soybean flour obtained the lowest score for its texture after that sample-2 obtained second lowest score than sample-2 and sample -3 got the highest score. The flavor and smell of the products depends on the volatile constituents of raw material. The flavor mean score were 4.50 ± 0.34, 4.75 ± 0.26, 4.00 ± 0.14, 3.50 ± 0.75 of normal, sample-1, sample-2 and sample-3 respectively. In the flavor and smell acceptability test showed that sample-1 liked by the judges and they also liked normal bread.

Table-4: Comparison of the different organoleptic quality parameters (Sensory evaluation) of breads.

Quality Parameters	Normal breads	Sample 1	Sample 2	Sample 3
	Points Mean ±SD	Points Mean ±SD	Points Mean ±SD	Points Mean ±SD
Crust color	3.50± 0.26	3.75 ± 0.17	4.00±0. 16	4.25±0 .12
Crumb appearance	4.50 ± 0.30	4.50 ± 0.05	4.25 ± 0.40	4.0 ± 0.57
Texture	3.50 ± 0.20	4. 50 ± 0.30	4.25 ± 0.56	4.25 ± 0.65
Flavor	4.50 ± 0.34	4.75 ± 0.26	4.00 ± 0.14	3.50 ± 0.75
Overall taste acceptance	4.50 ± 0.23	4.75 ± 0.23	4.25 ± 0.43	4.00 ± 0.57

3.4 Overall Taste Acceptability

Taste is also influenced by the quality of the raw materials used in the processing of breads. The mean taste score of bread were 4.50 ± 0.23, 4.75 ± 0.23, 4.25 ± 0.43, 4.00 ± 0.57 respectively shown in the Table-4. In taste acceptability test, Hedonic scale showed that the sample-1 bread was more acceptable comparing with all quality characteristics by the judge.

4. CONCLUSIONS

In conclusion, composite breads with soybean flour substitutions were found to be nutritionally preferable (have higher protein, fat and crude fiber content) to whole wheat bread. However, the scores for organoleptic analysis likes crust color, texture (mouth feel), and overall taste acceptance except for flavor crumb appearance in higher inclusion of

soybean flour to wheat flour. The composite breads would serve as functional food because of the high protein and fiber content. However, further investigation should be focused on the phytochemical (isoflavone) content and how to improve the organoleptic qualities and hence acceptability of soybean enriched breads.

5. REFFERENCE

[1] Dewettinck, K., Bockstaele, F. V., Kuhne, B., Van, W. D., Courtens, T., Gellynck, X. 2008 Nutritional value of bread: Influence of processing, food interaction and consumer perception. Rev. J. Cereal Sci. 48 243 - 257.

[2] Young, J. 2001. Functional bakery products: current directions and future opportunities. Food Ind. J. 4 136-144.

[3] Bakke, A. and Vickers, Z.2007. Consumer liking of refined and whole wheat breads. J. Food Sci. 72 : S473-S480.

[4] Jideani, V. and Onwubali, F. 2009. Optimisation of wheat-sprouted soybean flour bread using response surface methodology. Afr. J. Biotechnol. 8:6364-6373.

[5] Maneju, H., Udobi, C. E., Ndife, J. 2011. Effect of added brewers dry grain on the physicochemical, microbial and sensory quality of wheat bread. Am. J. Food Nutr. 39-43.

[6] Ndife, J. and Abbo, E. 2009. Functional Foods: Prospects and Challenges in Nigeria. J.Sci.Technol. 1: 1-6.

[7] Jideani, V.and Onwubali, F. 2009. Optimisation of wheat-sprouted soybean flour bread using response surface methodology. Afr. J. Biotechnol. 8: 6364-6373.

[8] Okoye, J. I. and Okaka, J.C. 2009. Production and evaluation of protein quality of bread from wheat cowpea flour blends. Cont. J. Food Sci. Technnol. : 1-7.

[9] T. Islam ., A. Chowdhury., M. Islam., S. Islam, Standardization of Bread Preparation from Soy Flour. Int. J. Sustain. Crop Prod. 2 (2007)15-20.

[10] Gharras, H. 2009. Polyphenols: food sources, properties and applications – a review. Int.J.Food Sci. Technol., 44 : 2512-2518.

[11] Gomez, M., Ronda, F., P. Caballero., A. Apesteguia, 2003. Effect of dietary fiber on dough rheology and bread quality. Eur. Food Res.Technol. 216 51-56.

[12] AOAC. 2002. Official methods of Analysis of AOAC, International, 16 editions, Washington, DC: Association of Official Analytical Chemist.

[13] Steel, R.G.D. and Torrie, J. H. 1980.Principles and Procedures of Statistics. McGraw Hill Book Co. Inc., New York.