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Blending of wheat and soybean for development of high protein biscuits

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Abstract

Protein Malnutrition is widely recognized as a major health problem. The use of protein-calorie sources of vegetable origin has been proposed a possible solution to this problem. In this regard, soybean has been used in various foods to mitigate the shortage of protein supplies. As the bakery consumption in whole world is very high, soy fortified biscuits will help in increasing intake of protein, fat and calories. The present study was conducted to blend soya bean with wheat at different levels to increase the protein content of biscuits. The different treatments were: T_0 (control with no soy flour), T_1 (30% SF) T_2 (25% SF), T_3 (20% SF), T_4 (15 %SF) and T_5 (10 %SF). Biscuits were evaluated for proximate composition and sensory parameters. In nutrient estimation of biscuits, protein content was maximum(19.25%) in treatment T_1, fat content was highest (17.15%) in treatment T_1, carbohydrate content was found maximum (64.02%) in treatment T_0, and the energy value was highest (464.63Kcal/g) in treatment T_1. Combinations of WF/SF significantly improved ($p<0.05$) the nutrient content of the blends when compared to wheat flour alone. The Biscuits with 10% SF scored maximum for all the sensory quality attributes. However the other treatments were also found to be acceptable.

Keywords: Biscuits, malnutrition, protein, soyabean, wheat

1. Introduction

Biscuits have become one of the most desirable snacks for both young and elderly people due to their low manufacturing cost, more convenience, long shelf-life and ability to serve as a vehicle for important nutrients (Akubor, 2003; Hooda and Jood, 2005) [3, 10]. Biscuits are high in carbohydrates, fat, and calorie but low in fiber, vitamin, and mineral which make it unhealthy for daily use (Serrem *et al*. 2011) [14]. Moreover, biscuits have only about 6–7% protein (Agarwal 1990) [1]. This may be achieved through incorporation of protein-rich ingredients from soybean and mushroom as a fortification of biscuits. Soybean (Glycine max), is an excellent health food and contains about 48 to 50% proteins. but only minimal saturated fat, 21% carbohydrates (Gopalan *et al*. 1999) [9], and sufficient amounts of minerals and vitamins. Moreover, most of the oilseeds contain 40–50% oil, where as soybean contains about 18% of oil (American Soybean Association 2004). Amino acid profile of soy protein is excellent amongst plant proteins. Hence, it is superior to other plant proteins as it contains most of the essential amino acids except methionine (FAO 1970) [8], which is abundant in cereals, and it is the most economical source of dietary protein. Soy protein directly lowers serum cholesterol levels (Mirrahimi *et al*. 2010) [12]. Regular consumption of soy food delays the process of aging and also improves mental and physical abilities, memory power, and hemoglobin levels of children (American Soybean Association 2004) [4]. Owing to these qualities, soybean has long been used in supplementary foods. The present study was conducted to fortify wheat flour with soy flour for biscuit production and to study the effect of different combination of soy flour on the nutritional and sensory quality of the developed biscuits.

2. Material and methods

Wheat flour and soya bean flour were procured from the local market. The flours were screened through a 0.25 mm sieve and stored at 4°C in a refrigerator to prevent spoilage particularly rancidity until usage. The soy flour (SF) was blended with wheat flour (WF) at different levels i. e. T_0 (control with no soy flour), T_1 (30% SF) T_2 (25% SF), T_3 (20% SF), T_4 (15 %SF) and T_5 (10 %SF). The formulation and preparation of biscuits is shown in Table 1.

Table 1: Formulation for soy incorporated wheat biscuits

	Wheat flour (%)	Soy flour (%)	Milk powder (%)	Egg (ml)	Sugar (g)	Sodium bicarbonate (g)	Salt (g)	Oil (ml)
T_0	90	0	10	24	40	1	0.6	20
T_1	80	10	10	24	40	1	0.6	20
T_2	75	15	10	24	40	1	0.6	20
T_3	70	20	10	24	40	1	0.6	20
T_4	65	25	10	24	40	1	0.6	20
T_5	60	30	10	24	40	1	0.6	20

2.1 Proximate analysis
The proximate composition (i.e., moisture, protein, fat, fiber, ash of soya-wheat biscuits were determined according to the standard analytical methods (AOAC 2000) [5].

2.1.1 Determination of moisture
Moisture content was determined by drying a sample in an oven at 70°C for 12 h, the weight loss incurred was calculated as:

$$\text{Moisture (\%)} = {\text{wieght loss on drying}}/{\text{weight of the sample}} \text{ X100}$$

2.1.2 Determination of protein
Protein content of the samples was determined using the Kjeldahl method. The method consists of three basic steps: (1) digestion of the sample in sulfuric acid with a catalyst, which results in conversion of nitrogen to ammonia; (2) distillation of the ammonia into a trapping solution; and (3) quantification of the ammonia bytitration with a standard solution. According to this method, percentage of crude protein content of the samples = % nitrogen × 6.25.

2.1.3 Determination of ash
Crucibles were first dried for about 2 h at 100°C in an oven and placed in a desiccator. They were cooled and about 2.0 g of sample was weighed into the crucible. The samples were then placed in a furnace at 600°C for 4 h. Percentage ash content was determined by weighing the resulting inorganic residue.

$$\text{Weight of ash (g/100 g of sample)} = \frac{(\text{Weight of the crucible + ash}) - (\text{weight of the crucible})}{\text{weight of the sample}} \text{X100}$$

2.1.4 Determination of fat
Fat content was determined using the Soxhlet extraction method. In this method, fat was determined by extracting the dried materials (food samples) with a light petroleum fraction in a continuous extraction apparatus. The solvent was distilled off and the extract was dried and weighed.

2.1.5 Determination of crude fiber
The moisture and fat-free sample was boiled with 0.255N H_2SO_4 and 0.313N NaOH, consecutively, for 30 min under a reflux condenser and each time the sample was washed well with boiling water to remove acid and alkali residues. The sample was then transferred into a crucible, dried overnight at 100°C and weighed (W1) in an analytical balance.
The crucible was heated in a muffle furnace at 600°C for 20 min, cooled, and weighed again (W2). The difference in the weights (W1 – W2) represents the weight of crude fiber.

$$\text{Crude fiber (g/100 g of sample)} = \frac{\text{W1} - \text{W21}}{\text{Weight of the sample}} \text{ X100}$$

2.1.6 Determination of carbohydrate
The content of the available carbohydrate was determined by the following equation (Induja *et al*. 2012) [11]:
Total carbohydrate (g/100 g of sample) = {100 − (moisture + ash + protein + fat + crude fiber)}.

2.1.7 Determination of energy content
Metabolizable energy was calculated following the formula Energy (kcal/100 g of sample) = (4 × Carbohydrate) + (4 × Protein)+ (9 × Fat) (Induja *et al*, 2012) [11].

2.2 Sensory evaluation
The sensory evaluation of the products was done on the basis 9-point hedonic scale scorecard. Each attribute was scored based on its intensity scaled on a 9-point hedonic scale (1 = disliked extremely, 2 = disliked very much, 3 = disliked moderately, 4 = disliked slightly, 5 = neither liked or disliked, 6 = liked slightly, 7 = like moderately, 8 = liked very much, 9 = liked very extremely) for colour, taste, texture, flavor and overall acceptability.

2.3 Statistical analysis
Data analysis was performed using Statistical Package for the Social Sciences (SPSS version 15.0 SPSS). Values were expressed as percentage and mean ± SD.

3. Results and discussion
3.1 Proximate composition
The results for moisture, ash, protein, fat, crude fiber, carbohydrate and energy value are given in table2.

Table 2: Proximate composition of soy fortified biscuits

	Moisture (%)	Ash (%)	Protein (%)	Fat (%)	Crude fiber (%)	Carbohydrate (%)	Energy (Kcal/g)
T_0	4.00±0.06	1.20±0.01	16.30±0.02	14.18±0.03	0.30±0.01	64.02±0.19	448.90±0.42
T_1(30%SF)	2.98±0.02	1.55±0.03	19.25±0.09	17.15±0.07	0.75±0.05	58.32±0.17	464.63±0.69
T_2(25%SF)	3.20±0.04	1.48±0.05	18.71±0.06	17.00±0.06	0.61±0.04	59.00±0.14	463.84±0.65
T_3(20%SF)	3.78±0.03	1.41±0.08	18.32±0.04	16.51±0.03	0.53±0.02	59.45±0.13	459.67±0.58
T_4(15%SF)	3.90±0.05	1.33±0.02	17.65±0.08	15.20±0.05	0.44±0.04	61.48±0.10	453.32±0.51
T_5(10%SF)	3.97±0.08	1.26±0.07	17.10±0.03	15.05±0.02	0.38±0.03	62.24±0.14	452.81±0.45

Results are expressed as Mean± SD
SF= soy flour

The moisture content (4.00%) was highest in control (To) biscuit. The results revealed that the moisture content decreased from 4.00 to 3.97% with the increase in soy flour. This may be due to the greater amount of total dry solids in soy flour with high emulsifying properties compared to wheat flour. The results are supported by the findings of Sutharshan *et al*. (2001) [16] who reported that increase in proportion of soy flour reduces the moisture content of the soy bean flour supplemented biscuits.

The highest ash content (1.55%) was recorded in treatment T_1(30%SF) and lowest (1.20%) in control (To) biscuit. The ash content gradually increased from 1.20-1.555 with the increase in soy flour. Siddiqui *et al*. (2003) [15] and Ayo *et al*. (2014) [6] reported the similar results on the supplementation of soy flour for the preparation of biscuits.

In the present investigation a gradual increase in the protein content was found with the increase in soy flour. Protein content was maximum (19.25%) in the treatment T_1 (30%SF) and minimum (16.30%) in control (T_0) biscuits. This increase could be due to the increase in the proportion of soy flour in the flour blend as soybean is a high-protein legume and an excellent complement to lysine-limited cereal protein and incorporation of soy flour inevitable increases the protein content in the biscuits. Ugwuona (2009) [17] showed protein content of biscuits increased with increasing soy fortifications. Siddiqui *et al*. (2003) [15] also reported the similar results in the soy fortified biscuits.

The fat content of the biscuits increased with the increase in soy flour. The highest fat content (17.15%) was found in treatment T_1 (20%) and lowest (14.18%) was recorded for control (To) biscuit. The increase in fat content in the present study may be due to the higher percentage of fat in soy flour than wheat flour. This results are in agreement with previous studies (Akubor and Ukwuru 2005; Banureka and Mahendran 2009; Ayo *et al*. 2014) [2, 7, 6].

With the increase in the supplementation of soy flour, the fibre content was increased. The highest crude fibre content (0.75%) was recorded in treatment T_1 (30%SF) and lowest (0.30%) in control (T_0) biscuits. Similar trends in increase in fiber content were also reported by Ayo *et al*. (2014) [6] on the supplementation of malted soy flour on the production of biscuits. The increase in fiber content could be due to the incorporation of soy flour in the blended flour as supported by a study of Ndife *et al*. (2011) [13] on soy flour supplementation in the production of bread.

The incorporation of soya flour resulted in decreased carbohydrate content with the highest (64.02%) recorded in control (T_0) biscuits and the lowest (58.32%) in treatment T_1 (30%SF). The decrease in carbohydrate content could be due to the low carbohydrate content of added soy flour (Gopalan *et al*. 1999) [9].

With the incorporation of the soy flour, the energy value of the biscuits increased. The highest energy value (464.63Kcal) was recorded in treatment T_1 (30%SF) and the lowest (448.90Kcal) in control (T_0) biscuits. A similar trend was also reported by Banureka and Mahendran (2009) [7].

3.2 Sensory scores

The sensory scores of soy fortified biscuits are given in table 3.

Table 3: sensory scores of soy fortified biscuits

	Colour	Taste	Texture	Flavour	Overall acceptability
T_0	8.3±0.4	9.0±0.5	8.4±0.6	9.2±0.7	8.5±0.4
T_1(30%SF)	7.0±0.2	7.3±0.3	7.4±0.3	7.5±0.4	7.3±0.2
T_2(25%SF)	7.0±0.3	7.5±0.4	7.6±0.4	7.8±0.3	7.4±0.5
T_3(20%SF)	7.5±0.2	8.0±0.3	7.7±0.5	8.2±0.5	7.8±0.2
T_4(15%SF)	8.0±0.5	8.4±0.6	7.8±0.2	8.5±0.4	8.1±0.5
T_5(10%SF)	8.8±0.4	8.7±0.5	8.0±0.4	8.9±0.6	8.6±0.6

Results are expressed as Mean± SD
SF= soy flour

Increase in soy flour decreased the mean score for color. The colour score was highest (8.8) for treatment T_5 (10%SF) and lowest (7.0) for treatment T_1 (30%SF). A similar trend was also reported by Banureka and Mahendran (2009) [7]. The score for taste was decreased from 9.0 to 7.4 with the increase in the level of incorporation of soy flour. Biscuit containing 30% soy flour (T_3) was rated poorest in taste (7.3). The control (To) has the highest mean score (9.0) for taste. The texture of the crust is related to the external appearance of the biscuit top which implies smoothness or roughness of the crust. With the increase in substitution of soy flour to the biscuits, the texture of crust was decreased from 8.4 to 7.4. The control (To) had the highest (8.4) mean value and the treatment T_1 (30%SF) had the lowest(7.4) mean value. The score for flavour also decreased with incorporation of soy flour. Highest score (9.2) was recorded for control (T_0) biscuits and the lowest 7.5 for treatment T_1 (30%SF). This could be due to the beany flavour of soy flour (Akubor and Ukwuru 2005) [2]. Treatment T_0 (control) biscuits had the highest mean value (8.6) for overall acceptability and T_1 (30% soyflour-added) biscuits had the least mean value (7.3).

4. Conclusion

The biscuits fortified with 30% soy flour were nutritionally superior to that of the whole wheat flour biscuits. With regard to the sensory characteristics of T_5 (10%) were found to be the best. The other treatments were also found to be acceptable.

References

1. Agarwal SR. Prospects for small-scale biscuit industry in the nineties. Ind. Food Indust. 1990; 24:19-21.
2. Akubor PI, Ukwuru MU. Functional properties and biscuit making potential of soybean and cassava flour blends. Plant Foods Hum. Nutr. 2005; 58:1-12.
3. Akubor P. Functional properties and performance of cowpea/ plantain/ wheat flour blends in biscuits. Plant Food Hum. Nutr. 2003; 58:1-8.
4. American Soybean Association. United Soybean Board. Soy and Health. A review of the 3rd International Symposium on the role of soy in preventing and treating chronic disease. Washington DC, USA, 2004.
5. AOAC. Official methods of analysis of Association of Official Analytical Chemistry International. 17th ed. Association of Analytical Communities, Gaithersburg, MD, 2000.

6. Ayo JA, Ayo VA, Popoola C, Omosebi M, Joseph L. Production and evaluation of malted soybean-acha composite flour bread and biscuit. Afr. J Food Sci. Technol. 2014; 5:21-28.
7. Banureka VD, Mahendran T. Formulation of wheat-soybean biscuits and their quality characteristics. Trop. Agric. Res. Ext. 2009; 12:2.
8. FAO. Amino acid content of foods and Biological data on protein. Nutritional studies, 24. Food and Agriculture Organization of the United Nations, Rome, 1970.
9. Gopalan C, Shastri BUR, Balasubramania SC. Nutritive value of Indian Foods, National Institute of Nutrition, I C M R, Hyderabad, India reprinted. 1999, 1-156.
10. Hooda S, Jood S. Organoleptic and nutritional evaluation of wheat biscuits supplemented with untreated and treated fenugreek flour. Food Chem. 2005; 90:427-35.
11. Induja A, Pornoor S, Maitrayee T, Vandana T. Development of soy fortified high protein and high calorie supplementary biscuits. Indian J Sci. Res. 2012; 3(1):51-58.
12. Mirrahimi A, Srichaikul K, Berryman CE, Wang L, Carleton A, Abdulnour S, *et al*. Soy protein reduces serum cholesterol by both intrinsic and food displacement mechanisms. J Nutr. 2010; 140:2302S-2311S.
13. Ndife J, Abdulraheem LO, Zakari UM. Evaluation of the nutritional and sensory quality of functional breads produced from whole wheat and soy bean flour blends. Afr. J Food Sci. 2011; 5:466-472.
14. Serrem C, Kock H, Taylor J. Nutritional quality, sensory quality and consumer acceptability of sorghum and bread wheat biscuits fortified with defatted soy flour. Int J Food Sci. Technol. 2011; 46:74-83.
15. Siddiqui NR, Hassan M, Raza S, Hameed T, Khalil S. Sensory and physical evaluation of biscuits supplemented with soy flour. Pak. J Food Sci. 2003; 12:45-48.
16. Sutharshan S, Sriwardana TDW, Mahendran T. Development of maize-soy based supplementary food and evaluation of quality parameters. Proceedings of the 57th Annual Sessions, Sri Lanka Association for the Advancement of Science. 26th November – 1st December, 2001, 246.
17. Ugwuona FU. Chemical and sensory evaluation of soy-fortified cassava wheat biscuit. J Trop. Agric. Food Environment Ext. 2009; 8:55-59.