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Formulation of wheat - soya bean biscuits and their quality characteristics

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Abstract
Research was conducted to evaluate the quality characteristics of protein enriched biscuits which could be used as a protein supplemented cereal snack food. The use of soy flour to substitute it with wheat flour 20% and the possibility of using soya flour for the production of biscuit was investigated. Prepared biscuits were subjected to nutritional and hedonic analysis to evaluate the suitability of the biscuits for consumption. Protein, fat and energy value of soya flour supplemented biscuits increased with progressive increase in proportion of soya flour and 20% soya flour added biscuits for the wheat flour biscuits. The moisture was decreased with corresponding increase in the percentage of soy flour. Nine-point hedonic scale ranking method was used to evaluate the hedonic characteristics of prepared biscuits. Generally the mean scores for all the assessed hedonic characteristics decreased with increase in the soybean flour. Hedonic evaluation indicated that there were no significant differences between the control treatment and 20% soya flour supplemented biscuits in the hedonic attributes of appearance, taste, texture, colour and flavour but differences were significant in overall acceptability. From the overall acceptance rating, 20% soybean flour incorporated biscuit obtained the highest preference compared to other combinations.

Keywords: Nutritional quality, hedonic characteristics, Protein enrichment, Wheat flour - soya flour biscuit

1. Introduction
Biscuit is India's largest industry amongst food industries, with an estimated production of 70, 000 tonnes and cost of three thousand billions US Dollar. Biscuit along with bread forms major baked food accounting to over 30% and 50% respectively of total bakery products produced in the country. The industries have been established in organized and unorganized sectors contributing equal share. The bakery products produced in organized sector are well recognized as compared to organized sector products which are packed in sophisticated packaging. Biscuit is a diverse group bakery product ranging from varieties high and low in fat, high and low in sugar in more or less combination. Biscuits are available in wide varieties of shape, size, taste and texture. These varieties are coming from both organized and unorganized sector. However organized sector has very large capacity plants and their total number is few thousand. The number of units in unorganized sector is of order 80,000. Biscuits are fortified with wide variety of cereal like finger millet, gram flour, soy flour etc. Biscuit becomes an important source of high molecular carbohydrates, vegetable proteins and some vitamins and minerals. But it is important to know that, as compared to refined wheat flour which is deficient in certain essential amino acids thus requires a balanced nutritional value. Saghir Ahmad 2014**.**
Wheat flour is the principal component of virtually all biscuits because when mixed with water, it forms unique viscos-elastic dough. However, good quality biscuits can be prepared using non-wheat flours. The problem facing the bakery industry is the non-availability and or cost of wheat creating a need to substitute wheat flour with other cereal flours such as sorghum, which are cheaper and more sustainable in their ecological zone.
Wheat flour is the principal component of virtually all biscuits because when mixed with water, it forms unique viscos-elastic dough (Kent and Evers 1994). However, good quality biscuits can be prepared using non-wheat flours. The problem facing the bakery industry is the non-availability and or cost of wheat creating a need to substitute wheat flour with other cereal flours such as sorghum, which are cheaper and more sustainable in their ecological zone. Sorghum is an important source of energy and protein for a large segment of the human population in the semi-arid and arid tropics where it is too hot and dry for successful wheat and maize production. Hard, bread-type wheat, which is cultivated in some 33 countries in Africa, is also another important cereal staple in the semi-arid tropics of Africa (Taylor 2004) [6].
Soybean flours are increasingly being used in many countries because they are a good source of vegetable proteins, with a low fat content. The nutritional value of the soybean is not the only factor enhancing its consumption, as it plays and important role in health (Steinke, 1992). Soybean flour contains about 35-45% protein, on dry weight basis and therefore it is considered an excellent source of protein (Serrem *et al.,* 2011) [8] with all essential amino acids required for proper growth and maintenance of body. Beside this, it is high in vitamin, mineral and antioxidant like Isoflavones which helps in cholesterol reduction, preventing cancer and regulation of menopause.
Proteins contribute to cell growth, repair and maintenance, act as enzymes and hormones, maintain fluid, electrolyte and acid base balance and also maintain a strong immune system (Thompson *et al* 2008) [12]. When fats and carbohydrates are not provided in adequate amounts in the diet, proteins also serve as an energy source, limiting their availability for the functions stated earlier. Additionally, proteins act as carriers for other nutrients that include lipids, Vitamin A, iron, sodium and potassium. Consequently, protein deficiency in children is

also accompanied by other nutrient deficiencies including micronutrient deficiency (Muller and Krawinkel 2005) [13].

Grain legumes, like Soybean (*Glycine max*) is an excellent source of protein (40-45%); hence the seeds are the richest in food value of all plant foods consumed in the world. It is also rich in calcium, iron, phosphorous and most of the vitamins. It is the only source that contains all essential amino acids. The usefulness of the grain legumes in developing high protein foods in meeting the needs of the vulnerable groups of the population is now well recognized and several high protein energy foods have been developed industrially in different parts of the world. Soybean plays 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 and 4 times of milk. Soybean has 3% lecithin, which is helpful for brain development (Akubor and Ukwuru 2005). Wheat (Triticum aestivum L) is one of the important cereal grains because of its use for the preparation of many baked products. Unfortunately, lysine is the first limiting amino acid in wheat flour and more than 10% of which is being destroyed during baking.

In this study, efforts have been made to supplement wheat flour with soybean flour to develop nutritionally protein–enriched biscuits. At the same time, the utilization of soybean may encourage the farmers to grow more soybeans. Thus, the malnutrition problem may be solved and the poverty in the country could be reduced to a certain level.

2. Methodology

i) Raw materials

Commercially available wheat flour and soybean seeds were procured from wholesale trader.

ii) Preparation of soybean flour and wheat flour

The soybean seeds were processed into flour using the method of IITA (1990). Soya bean seeds were sorted and soaked in water. Thereafter, the seed coat was removed and drained. The seeds were than cleaned and Boiled and sun dried. The dried seeds were milled in to flour. The flours were screened sieve and stored refrigerator to prevent spoilage particularly rancidity until usage. The process ensures effective removal of the anti-nutritional factors.

Wheat flour was mixed with soy flour and biscuits were prepared according to the following treatments using the recipe described below:

iii) Treatment

Sample 1: 10g Soybean flour + wheat flour/100g mixture
Sample 2: 20g Soybean flour + wheat flour /120g mixture

iv) Boiled and sundried sample

Boiling was done for 30 min (Muller 1988) drained and sun dried in the open air for four days to a constant weight.

v) Schematic Diagram for the study

Soya bean
↓
Boiling
↓
Sun drying
↓
Milling
↓
Soya flour

vi) Milling of soy samples

Each of the treated samples was milled to flour with an attrition mill driven by a 5 hours power electric motor. The plate mill has burns of 300 mm diameter, splined at 25° to the horizontal and a variable screw conveyor of 12 mm pitch length. The milling was done at gap set of 0.6 mm through only one milling run.

vii) Development of Protein enriched biscuits

Hydrogenated fat (margarine) 50g and sugar 50g were milk powder together by cashew nuts and ghee. All-purpose wheat flour, soya flour and baking powder 3g were sieved twice together. The sieved flour and egg were added to the creamed paste. As per the treatment, firm dough was prepared from all mixture. The dough was rolled out to 2.5mm thickness in a baking tray and cut into round in shape having 5cm diameter with a biscuit cutter. The biscuits were placed in greased aluminium trays and baked in a pre-heated oven at 150ºC for 4min. These biscuits were assessed for nutritional and organoleptic qualities.

viii) Nutritional analysis

The moisture, ash, protein and fat of the biscuits were determined according to the standard AOAC (2000) methods. The carbohydrate content was determined by calculated difference and calorie value was estimated by multiplying the proportion of protein, fat, fibre and carbohydrate by their respective physiological energy values and taking the sum of the products.

ix) Sensory analysis

The sensory attributes including taste, colour, texture, flavour and overall acceptability were evaluated by a trained 20-member panel and untrained 10-member panel. The evaluation was held either 10 am for the morning session and at 2 pm for the afternoon session. The Nine-point hedonic scale was used to evaluate the degree of liking and disliking for preference of the biscuits. The mean scores were analysed using analysis of variance (ANOVA) method and difference separated using‘t’ test.

3. Results and Discussion

Composition of soybean flour

The nutritional composition of studied soya flour were moisture 11.5%, protein 40.2%, fat 19.7%, ash 4.6% and total soluble carbohydrate 24.1%. This is accordance with Gopalan *et al.* (1991).

Nutritional composition of wheat - soybean biscuits

The nutritional analysis of the biscuits indicated that all the biscuits contained favourable proportion of protein and fat.

Protein content

Nutritionally, soya bean protein is an excellent complement to lysine-limited cereal protein, hence the basis for the use of soya flour as an economical protein supplement in biscuit, bread, pasta and other cereal products (Hegstad 2008) [10]. The

protein content of the biscuits increased from12.21to19.72 with the increase in soybean flour from biscuits.
The increase in protein content could be due to the increase in the proportion of soybean in the flour blend. Soybean is a high protein legume and incorporation of soy flour inevitable increase the protein content in the biscuits. Addition of soy flour increase the protein, fat and the essential amino acids content thereby has a greater potential in overcoming protein-calorie malnutrition in the world (Akubor and Ukwuru 2005) [1].

Fat content

Soybean is a protein rich oil seed, which is presently number one edible oil source globally. Soybean is rich in polyunsaturated fats, including the two essential fatty acids, linoleic and linolenic, that are not produced in the body. Linoleic and linolenic acids aid the body's absorption of vital nutrients and are required for human health (Hegstad 2008) [10]. Soybean oil is 61% polyunsaturated fat and 24% monounsaturated fat which is comparable to the total
Unsaturated fat content of other vegetable oils (85%). The fat content of the biscuits increased from 15.85 To 54.03 with increase in soybean flour from biscuits.
The increase in the fat content could be due to the increase in the proportion of soybean in the flour blend. This could be due to the fact that soy flour contained higher percentage of fat than wheat flour. Our results are in agreement with the finding of Akubor and Ukwuru (2005) [1]. Reddy (2004) re-ported that soy flour contained 20–24% of fat whereas wheat flour contains 0.9–1.1% and most of which are unsaturated in nature.

Table 1: Chemical composition of wheat flour and soya flour 100g Sample-1

S. No	Nutrients analysis 100g	Wheat flour	Soya flour
1	Carbohydrate (kcal)	47.97	33.62
2	Protein (g)	10.21	15.72
3	Fat (g)	2.50	19.5
4	Fiber (g)	10	1.17

The chemical composition of sample I wheat flour indicated that the carbohydrate 71.97(g); protein 12.21(g); fat 2.50(g); fibre 10(g); is respectively. The chemical composition of soy bean flour indicated that the carbohydrate 33.62(g), protein 19.72(g); fat 20.5(g); fibre 1.17(g) respectively.

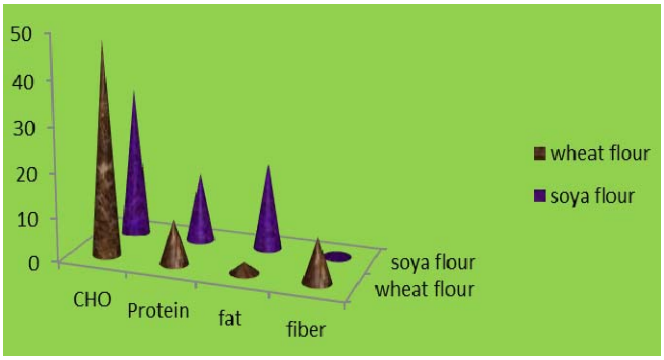

Fig 1: Chemical composition of wheat flour and soya flour

Table 2: Chemical composition of wheat flour and soya flour 120g (Sample-2)

S. No.	Nutrients analysis 120g	Wheat flour	Soya flour
1	Carbohydrate (kcal)	66.36	40.62
2	Protein (g)	15.85	54.03
3	Fat (g)	12.8	28.4
4	Fiber (g)	3.00	2.28

The chemical composition of sample 2 wheat flour indicated that the carbohydrate 86.36(g) protein 15(g); fat 12(g); fibre 3(g); is respectively. The chemical composition of soy bean flour indicated that the carbohydrate 40.62 (g), protein 54.03(g); fat 28.4(g); fibre 18,28(g) respectively.

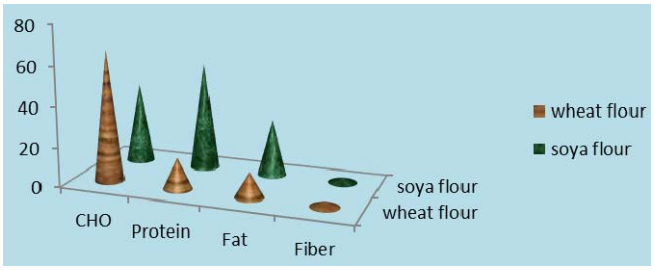

Fig 2: Chemical composition of wheat flour and soya flour 120g Sample-

Table 3: Sensory attributes of biscuits incorporated with different levels of soy flour

S. No.	Scoring	Sample 1	Sample 2
1	Appearance	4.8±1.145	5.9±0.2c
2	Texture	4.66 ± 0.260	6.5±0.3bc
3	Taste	4.833 ± 0.372	5.8±0.4b
4	Flavour	4.7±0.458	5.4±0.3b
5	Over all acceptability	4.66±0.327	6.0±0.3d

The mean and standard deviation value of sample 1 and sample2 appearance was 4.8±1.145, 5.9±0.2c. The mean and standard deviation value of sample 1 and sample 2 textures was 4.66±0.260, 6.5±0.3bc. The mean and standard deviation value of sample 1 and sample 2 taste was 4.833±0.372, 5.8±0.4b. The mean and standard deviation value of sample 1 and sample 2 flavours was 4.7±0.458, 5.4±0.3b. The mean and standard deviation value Overall acceptability was 4.66±0.327, 6.0±0.3d respectively.

4. Conclusion

Soya flour incorporation in whole wheat flour significantly improved the protein, crude fibre and ash contents of the composite flour. The crude fat content decreased in composite flour by biscuits of defatted soy flour while fat increased by the incorporation of soya flour. The nitrogen free extract of the composite flours decreased by increasing soya flour in the whole wheat flour.

- The mineral content of the composite flours also improved significantly the incorporation of full fat or defatted soy flour into whole wheat flour.
- The amino acids profile of the whole wheat flour was also improved by biscuits of soya flour, especially the lysine

content which is the most deficient amino acid in wheat flour also increased significantly.

- The full fat soy flour into whole wheat flour significantly improved the polyunsaturated fatty acids composition of the composite flours.
- The autoclaving of soya beans significantly reduced the trypsin inhibitors and phytic acid contents in the composite flours and these anti-nutrients reduced further during baking of Biscuits.

The finding of this research revealed that biscuits produced with soya flour substitution up to 20% were nutritional superior to that of the whole wheat flour biscuits. To obtain biscuits of high nutritional and organoleptic qualities wheat flour could be substituted with 10% of soya flour. Organoleptic treatment sample 1 (10) was found to be best and in biochemical analysis treatment sample 2 (20) was found to be the best. It might be because highest percent of soya flour was added. To Sample 2 (20) and soya bean has high protein fat fibre content. Biscuits consumption in whole world is very high soya fortified biscuits will help in increasing intake of protein, fat and calories.

5. Reference

1. Akubor PI, Ukwuru MU. Functional properties and biscuit making potential of soybean and cassava flour blends. Plant Foods for Human Nutrition 2005; 58(3):1-12.
2. AOAC Official methods of Analysis, Association of Official Analytica, 2000.
3. Aly M Saleh, Abdel moneim E Sulieman, Asma O. Mohammed, El Amin A Elkhalifa. Evaluation of the chemical and sensory characteristics of biscuits supplemented with soybean flour Journals of University of Gezira. 2008, 6(1). ISSN: 1728-9556.
4. Saghir Ahmad, Neha M, Ramesh C. Development of functional biscuit from soy flour &rice bran, International Journal of Agricultural and Food Science. 2014; 2(1):14-20.
5. Saab *et al.* Stipanuk Rai S. *et al.* Quality characteristics of gluten free cookies prepared from different flour combinations, J Food Sci Technol. 1999. DOI 10.1007/s13197-011-0547.
6. Taylor, Sahi UC Lohani, Khan Chand. Optimization of process variables for preparation of apple pomace - black soy flour based biscuits. 2004; 2(1):101-106.
7. Stipanuk, Chauhan GS. Development of soy fortified biscuits and shelf life studies. Journal of Food Science and Technology. 2006; 37(3):333-303.
8. 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.
9. Gopalan, Yufei Hua *et al.* Composition, Structure and Functional Properties of Protein Concentrates and Isolates Produced from Walnut (Juglans regia L.) Int. J Mol Sci. 1991; 13:1561-1581.
10. Hegstad HG. Nutritional and Health benefits of Soybean. Soy Protein Quality Evaluation Report, Food and Agriculture Organization of the United Nations, Food and Nutrition Paper No. 71, Rome, Italy, 2008.
11. Friedman, Suresh Gopalani. Diet and nutrition, First edition 2004, 85-86.
12. Thompson R Vetrimani, K Leelavathi. Influence of Fibre from Different Cereals on the Rheological Characteristics of Wheat Flour Dough and on Biscuit Quality, Food Chemistry 2008; 100(4):1365-1370.
13. Muller, Krawinkel, Jood S. Organoleptic and Nutrition Evaluation of wheat breads supplemented with soybean and barley flour. Food Chem. 2005; 77:479-488.