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Research Article

Organoleptic and nutritional assessment of sesame (*Sesame indicum*, L.) biscuits

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Abstract: Sesame biscuits were prepared with the incorporation of 5-8% defatted sesame meal in the standard formula for making biscuits. These biscuits were then evaluated for their chemical and microbiological characteristics. The data indicate a rise in protein content over the traditional product. The sensory evaluation of these biscuits indicates their wide acceptability.

Keywords: snacks, defatted sesame flour, protein content, NSI, WAC, India

Introduction

Sesame (*Sesame indicum* L.) also known as gingely, beniseed, sim-sim and till, is an important annual oilseed crop in India. It is one of the earliest known condiments and crop grown for edible oil. Sesame is often consumed directly in sweetmeats and snacks. Most of the sesame seeds are used for extraction of oil .The seed has been called "***queen of the oil seed crop***" because of the high yield of oil and its quality. Sesame is grown primarily in less developed tropical and subtropical areas of Asia, the Mediterranean and South America. China and India are the largest producers. Sesame oil is used mainly for cooking purposes as it is aromatic, enhancing the flavour of food. A small percentage of oil is also used in pharmaceuticals, cosmetics and perfume products, as well as for the manufacture of soap, paint and insecticides. The dehulled and defatted meal is used as cattle feed and manure. It has potential use in food products as a protein and methionine supplement, hence there is a need to utilize the defatted sesame meal for edible purposes. Biscuits are convenient and inexpensive food products that are becoming very popular in India. There is an ever growing demand for their therapeutic value. Owing to their long shelf life, biscuits are considered for many nutritional programs in different countries.

The incorporation of defatted sesame meal may improve the nutritive value of the biscuits. It was therefore planned to carry out the present investigation to make edible grade sesame flour and prepare the biscuits with different levels of fortification for improving the nutritional profile.

Materials and Methods

Sesame seeds

Commercial varieties of white and black sesame seeds were procured from the local market. They were cleaned thoroughly, removing any dirt, foreign matter and stubble, before being stored in airtight containers until further use.

Preparation of defatted sesame meal

The sesame seeds (black and white) were soaked in water at ambient temperature over night. The hulls were completely removed by flotation technique through hand rubbing. The seeds were later dried at 60°C for 12 hours. Cold extraction method was used to extract the oil from the seed. Petroleum ether was used for 72 hours followed by n-hexane for another 24 hours. The ratio of seed to solvent was 4g: 15 ml. The solvent was changed at 12 hours intervals. The defatted seeds were washed finally with n-hexane three times and then de-solventized. The seeds were then ground to obtain the defatted sesame flour.

Preparation of biscuits

The defatted sesame meal from the white seeds was used for making the biscuits. The following recipes were formulated and biscuits were prepared using the standard procedure [1]. All these ingredients were purchased from the local market.

Table 1. Recipes used in biscuit preparation.

Ingredients	Category					
	1	2	3	4	5	6
Sesame flour	16	10	16	10	-	-
Milk powder	4	10	4	10	4	4
Maize flour	10	10	-	-	10	-
Rice flour	-	-	10	10	-	10
Powdered sugar	54	54	54	54	54	54
Maida	61	61	61	61	61	61
Veg. shortening	52	52	52	52	52	52
Baking soda	1	1	1	1	1	1
Baking powder	2	2	2	2	2	2

*Category5&6 are controls.

Analytical methods

The moisture, crude protein, crude fat, total carbohydrates, crude fibre and available free amino acids were determined using AOAC methods [2]. Phytate was evaluated by the Latta and Eskin method [3]. Nitrogen solubility index was determined using the method of AOCS [4]. Water absorption capacity was assessed by the method of Sosulski *et al*. [5]. Total fungal, bacterial, coliforms and Salmonella were determined using standard plate count (SPC) technique as given in APHA [6]. All the chemicals used were of analytical grade and procured from the local market. The experiments were conducted in triplicate and the values presented were the mean of these replications.

Sensory evaluation

Organoleptic assessment for overall acceptability was done using a taste panel consisting of 15 untrained members. The panelists were asked to evaluate the products for overall acceptability (appearance, colour, texture and flavour). A 9 point hedonic scale ranging from 9 (like extremely) to 1 (dislike extremely) was used for sensory evaluation and ANOVA was analyzed [7].

Results and Discussion

Chemical composition of defatted sesame flours

The chemical composition and nutritional properties of sesame meal from both the varieties were analyzed and presented in Table 2. The data indicate that the meals contain about 48-51% protein which may be used for the fortification enrichment of the regular biscuits. The water absorption capacity is also in the range of 320-360% which is significantly higher.

Table 2. Nutritional and functional profile of sesame meal.

Characteristics	Defatted sesame flour	
	White seeds	**Black seeds**
Moisture content (wb), %	8.9	10.4
Crude protein, %	51. 5	47.6
Crude fat, %	1.1	2.0
Total carbohydrates, %	26.8	25.7
Crude fiber, %		
Available free amino acids, mg/g	5.0	3.6
Phytic Phosphorus, mg/g	167.0	175.0
NSI, %	17.6	20.7
WAC, %	320.0	360.0

The defatted sesame meal was used for preparing the biscuits using the standard formula with appropriate fortification as stated earlier. The biscuits so prepared were characterized for their nutritional and microbial levels and the data are given in Table 3.

Table 3. Chemical and microbiological characters of sesame biscuits.

Component	Value. %					
	1	**2**	**3**	**4**	**5**	**6**
Protein	8.3	7.0	8.5	7.1	4.2	4.5
Fat	27.1	27.5	27.0	27.0	27.0	27.0
Carbohydrates	54.0	53.5	57.5	57.0	52.0	55.5
Fibre	3.3	2.5	3.4	2.4	1.8	1.9
Ash	5.8	5.4	5.9	5.5	5.0	5.1
Total fungal/gx10^3	1.0	0.6	0.5	1.1	0.5	0.4
Total bacterial/gx10^3	2.2	1.9	2.0	2.0	1.6	1.4
Coliforms	-	-	-	-	-	-
Salmonella	-	-	-	-	-	-

The results show that the protein content increased from 4.2-4.5% to 7.0-8.5% and the crude fibre from 1.8-1.9% to 2.4-3.4% with the incorporation of 5-8% defatted sesame meal in the standard formula. They are free from coliforms and Salmonella. These results are in accordance with those reported earlier on the fortification of sesame flour in preparing millet biscuits [8]. The biscuits were also subjected to sensory evaluation. The mean score values for different sensory characteristics are shown in Table 4. The scores were assigned in comparison with control biscuits (score of nine). The mean scores for all of the characters and overall acceptability was more than the minimum acceptable score of five.

Table 4. Mean scores of sensory characteristics of sesame biscuits.

Sample	Mean scores					
	Colour	**Appearance**	**Flavour**	**Texture**	**Taste**	**OA**
1	8.0	7.5	8.9	9.0	8.4	8.4
2	8.5	7.0	8.4	8.7	8.3	8.6
3	8.2	7.7	8.3	8.6	8.6	9.0
4	8.6	7.9	8.5	8.8	8.4	8.9

A separate analysis of variance was done for each character namely, taste, appearance, flavour, texture, taste and overall acceptability from every individual score of the taste

panel. This analysis was carried out to find out the differences among the characteristics and panelists. The results are depicted in Table 5.

Table 5. Analysis of variance of taste panel scores for the characteristics of different sesame biscuits.

Source of variation	Mean sum of squares						
	DF	Colour	Appearance	Flavour	Texture	Taste	OA
Products	3						
Judges	14						
Error	42						

- Significant at 5% level of significance
- **Non significant at 5% level of significance

The results indicate that the difference among the treatments is significant for, and non significant for, at 5% level significance. The disagreement among the judges for all these characteristics was not significant at 5% level of significance. Thus the data reveal that the source of variance among the products is only due to characteristics like and the variance due to judges does not exist. Gandhi *et al*. [9] also reported similar results with fortified soy biscuits which were developed for similar purpose of protein enrichment and improving the overall quality.

Conclusions

From the study it may be concluded that the biscuits with sesame meal incorporation improved the protein profile over control and all were acceptable. They may be included in applied nutrition programs of the country. This is also a value addition to the meal which is otherwise being used only as a feed and manure. It may be an additional source of income generation. Further studies are required to find out the feasibility of preparing other bakery products.

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