



EFFECT OF STORAGE ON QUALITY EVALUATION OF COOKIES SUPPLEMENTED WITH GERMINATED FENUGREEK SEED POWDER

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ABSTRACT

In view of the promising nutritional and health benefits of fenugreek seed, in the present investigation, sincere efforts have been made to fortify cookies with germinated fenugreek seed powder and studied the effect of storage at ambient atmospheric conditions for the period of 2 months on physico-chemical properties, peroxide value, acid value, microbial and sensory characteristics of cookies packed in LDPE. Peroxide value and acid value were lower than maximum recommended level and thus safe to consume. Based on the results obtained in the study it was concluded that cookies could be best preserved up to 2 months at ambient atmospheric condition under LDPE without appreciable quality loss.

KEYWORDS: Germinated fenugreek seed powder, Cookies, LDPE, Storage stability.

INTRODUCTION

Cookies are convenient food products, becoming very popular among both rural and urban populations of India. Some of the reasons for such wide popularity are low cost among other processed foods, varied taste, easy availability and longer shelf life. The enrichment of protein may be achieved through incorporation of protein-rich non-wheat flours. Among them fenugreek seed flour has a great potential, due to its high and good quality protein (20–25%), lysine (5–6%), soluble (20%) and insoluble dietary fibre and, it also possesses hypocholesterolemic properties (Hooda and Jood, 2005). Hence, development and consumption of such therapeutic bakery products would help to raise the nutritional status of the population. Information on incorporation of treated and untreated fenugreek seed flour in bakery products is scanty.

Hence, present study was conducted with objective to utilize germinated fenugreek seed powder to prepare cookies and to study shelf stability for two months at an interval of 15 days on the basis of physico-chemical parameters and sensory attributes. Cookies developed will show good functional characteristics with improved health benefits (more fiber and protein content) due to germinated fenugreek seed powder. The decision to adopt utilization of germinated fenugreek seed powder was motivated by the need to improve nutritional status, physical state and the functionality of end product.

MATERIALS AND METHODS

Raw materials and reagents

Fenugreek seeds and other required materials were procured from the local market. All the chemicals used in present investigation were of analytical grade and obtained from the Department of Food Chemistry and Nutrition,

College of Food Technology, VNMKV, Parbhani (MS), India.

Development of cookies

The cookies were prepared by partial replacement of refined wheat flour with germinated fenugreek seed flour to the extent of 5, 10 and 15% keeping the sugar and fat amount constant to 40 and 35 g respectively on 100 g flour basis. Fat and ground sugar was creamed in a mixer with a flat beater for 2 min at slow speed. The flour, required amount of milk and 1.5 g ammonium bicarbonate were added to the creamed mixture and mixed for 8 min at medium speed in dough mixer to obtain a homogenous mixture. The batter was sheeted to a thickness of 4.5 mm with the help of rolling pin and an aluminum frame of standard height. The cookies were cut with cookie die to desired diameter of 50 mm and transferred to a lightly greased aluminum baking tray. Baking was done at 180°C for 15 min in a baking oven, cooled and stored in an air tight container. Based on sensory evaluation cookies with 10 per cent fortification of germinated fenugreek seed flour were selected for further analysis (Ferial and Azza, 2011).

Physical characteristics of cookies

Developed cookies were evaluated for physical characteristics like weight; diameter, thickness and spread ratio were calculated by standard procedures (Ferial and Azza, 2011).

Peroxide value

Weight 5 g of oil into 500 ml conical flask, add 30 ml acetic acid chloroform mixture and dissolve the oil. Add 0.5 ml saturated potassium iodide solution mix well and allow standing for 1 min. Add 30 ml of water, 3-4 drops of starch indicator and mixing well. Titrate against standard 0.01N sodium thiosulphate with vigorous shaking to liberate all from chloroform layer until the blue colour just

disappears. Treat the blank similarly in the absence of oil. (A.O.A.C., 2005).

$$\text{Peroxide value (meqO}_2\text{/Kg oil)} = \frac{\text{Titer value- Blank Value} \times 1000}{\text{Weight of oil}}$$

Acid value

The free fatty acid in oil is estimated by titrating it against KOH in presence of phenolphthalein indicator. Dissolve 1-10 g of oil in 50 ml of 95 per cent ethanol and add few drops of phenolphthalein. Titrate against 0.1N potassium hydroxide. Shake constantly until a pink colour which persists for fifteen seconds is recorded. However, free fatty acid is expressed as oleic equivalents. 1 ml 0.1N KOH= 0.028 g oleic acid (A.O.A.C., 2005).

$$\text{Acid value (mg KOH/g oil)} = \frac{\text{Titer value} \times \text{Normality of KOH}}{\text{Weight of sample (g)}}$$

Sensory analysis

The sensory evaluation of cookies was carried out by a 10 member semi-trained panel. Panelists recorded their perceptions of each attribute in terms of the score. Judgements were made through rating products on a 9

point Hedonic scale with corresponding descriptive terms ranging from 9 ‘like extremely’ to 1 ‘dislike extremely’ (Ranganna, 2000).

Microbial Analysis

The Nutrient agar media (NA) was used for total plate count, while potato dextrose agar (PDA) for yeast and mold. Serial dilutions were made for each sample and 1 ml of the appropriate dilution was poured, 10⁻² and 10⁻¹ serial dilution were used for pour plate in triplicate on selective media. Culture media was incubated at 37⁰ C for 24 hrs for enumeration of the total microbial load in incubator. Developed colonies were expressed as colony forming units per gram (cfu/g) of sample.

Statistical analysis

The results were statistically analysed in a completely randomized factorial design according to the standard method of Panse and Sukhatme (1987).

RESULTS

Effect of Storage on Physical Properties of Cookies

Effect of storage on the physical properties of cookies packed in LDPE was analyzed at ambient atmospheric condition for 60 days and results are shown in (Table 1).

TABLE 1: Effect of storage on physical properties

Storage period (Days)	Physical characteristics			
	Weight (g)	Diameter (cm)	Thicknes s (cm)	Spread ratio
Fresh	14.13	5.12	0.93	5.50
15	14.13	5.17	0.89	5.80
30	14.12	5.21	0.85	5.85
45	14.11	5.26	0.82	6.41
60	14.10	5.31	0.78	6.80
SE ±	0.008	0.006	0.010	0.012
CD	NS	0.020	0.031	0.037

*Values are means of three determinations

No any significant effect on the weight of cookies was observed. During storage, significantly increased trend was observed in diameter of cookies. Average values for diameter ranged from 5.12 to 5.31 cm while maximum value appraised at 60 days showing increasing trend in diameter as function of storage. Crude fiber addition may also be a factor for having potential to absorb moisture from the surrounding during storage. Similarly, significant differences due to treatments and storage were also observed by Hussein *et al.* (2011). Results for storage study explicated in table shows reduction in thickness as

means determined at fresh was 0.93 cm that decreased to 0.78 cm at 60 days. Similarly, Tahira *et al.* (2014) also reported decrease in thickness in cookies during storage. Spread ratio increased significantly during two months as minimum value was observed at the initiation of the study (5.50) while maximum (6.80) perceived at the termination stage.

Effect of Storage on Peroxide & Acid Value of Cookies

The data pertaining to storage stability of cookies with respect to peroxide value and acid value is presented in (Table 2 and Fig. 1).

TABLE 2: Effect of storage on peroxide and acid value

Storage period (Days)	Peroxide value (meq O ₂ /kg)	Acid value (mg KOH/g)
Fresh	3.18	0.26
15	3.65	0.32
30	4.06	0.47
45	4.59	0.52
60	5.17	0.68
SE	0.008	0.006
CD @ 5%	0.024	0.020

* Values are means of three determinations

It is observed from Fig. 1 that peroxide value and acid value significantly increased with the increase in storage period. Oxidation processes are of particular significance in cookies as they contain a high amount of fat. Peroxide value was found to be increased from 3.18 meqO₂/kg to 5.17 meqO₂/kg. This increase was might be due to oxidation of unsaturated fatty acids in oil. However, the cookies are stable as the peroxide value was less than 10

meqO₂/kg (permissible limit for peroxide value is 10 meq O₂/kg). The findings were in well accordance with the results reported by Amin *et al.* (2016). The acid content in alimentary fats is expressed by the quantity of free fatty acids (FFA) generated in hydrolytic deterioration (rancidity) of triacylglycerols that occurs under unsuitable storage conditions of fats (Koczon *et al.*, 2008).

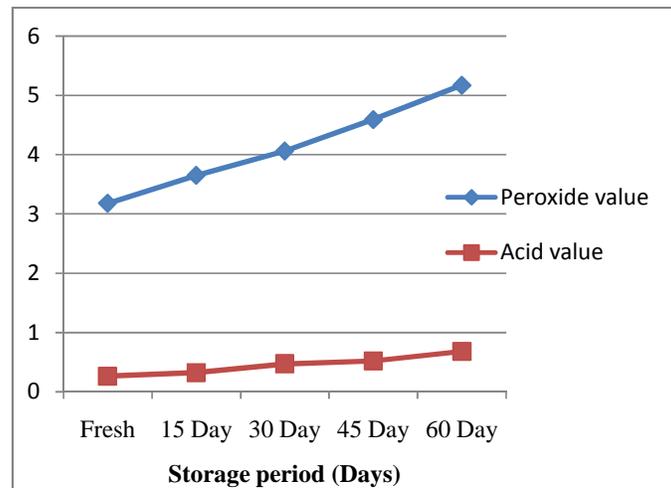


FIGURE 1: Effect of Storage on Peroxide Value and Acid Value of Cookies

The content of FFA in cookies measured by acid value and it was found to be increased with the increase in storage period. It ought to be emphasized that in this study, acid value did not exceed 1.5 mg of KOH/g of fat (0.75 per cent FFA), which was considerably lower than the recommended maximum level of 5 per cent FFA in products for human consumption (Pomeranz 1992).

Effect of Storage on Sensory Characteristics of Cookies

Effect of storage studies for 60 days on sensory characteristics of cookies at ambient temperature was analyzed and results are presented in (Graph 2).

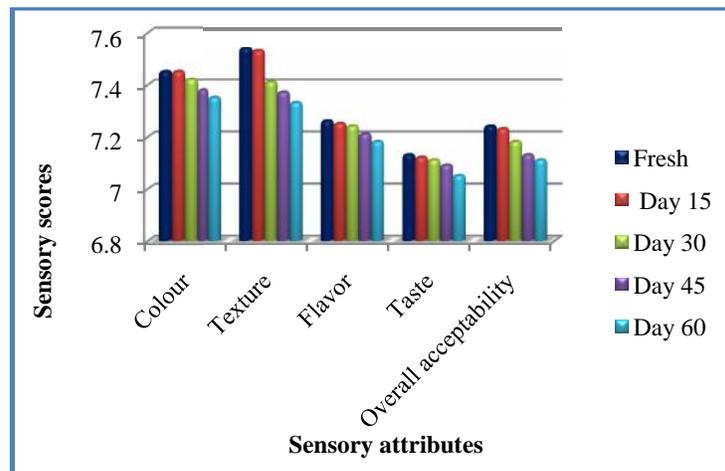


FIGURE 2: Effect of Storage on Sensory Characteristics of Cookies

Overall acceptability of cookies differs significantly up to 60 days of storage. Cookies had 7.24, 7.23, 7.18, 7.13 and 7.11 overall acceptability scores at fresh, 15, 30, 45 and 60 days of storage respectively. Overall acceptability of cookies decreased significantly with the increase in storage period from fresh to 60 days. It was therefore, concluded that overall acceptability scores of GFSP supplemented cookies were still in the category of ‘Like

moderately’ up to 60 days of storage. Hence, cookies supplemented with germinated fenugreek seed can be stored safely in LDPE at ambient temperature for 60 days without any adverse changes in the organoleptic traits. The present results were in confirmatory with the outcomes of Hooda and Jood (2005) who concluded that the fenugreek seed fortified biscuits can be safely stored in

polypropylene bags up to 1 month without altering their organoleptic properties.

Microbial Analysis of Cookies during Storage

The data pertaining to the microbial analysis in terms of Total plate count (TPC) as well as Yeast and Mold count (YMC) of cookies at ambient temperature for the storage period of 60 days is presented in (Table 3).

TABLE 3: Microbial analysis of cookies during storage

Storage period (Days)	Total plate count (cfu/g) × 10 ¹	Yeast and mold count (cfu/g) × 10 ¹
Fresh	ND	Not Detectable
15	1.0	Not Detectable
30	1.3	Not Detectable
45	1.5	Not Detectable
60	1.7	Not Detectable

*Values are means of three determinations

It is evident from Table 3 that TPC of cookies fortified with GFSP was found to be increased with the storage. TPC of control sample was found to be non detectable whereas, the highest TPC was observed at the end of 60th day as 1.7×10¹ cfu/g. Yeast and molds were not detected in product throughout the storage of 60 days. It was might be due to thermal processing, low water activity and hygienic practices followed during processing. According to Banusha and Vasantharuba (2014), the safe level of bacterial count for cookies should be below 1×10⁴ cfu/g. Microbial study shows that the microbial counts (TPC and YMC) were within the accepted range and cookies made were safe to consume. Thus, microbiological studies have proved it to be safe, thus making it an excellent and novel product.

CONCLUSION

The present study attempted to study the shelf life stability of cookies fortified with germinated fenugreek seed powder. During storage study, moisture and carbohydrate content was increased gradually where as other components like fat, protein, fiber and ash found to be decreased. Peroxide value and acid value significantly increased with the increase in storage period, but still it was lower than maximum recommended level and thus safe to consume. Microbial study shows that the microbial counts (TPC and YMC) were within the accepted range and cookies made were safe to consume. Hence it was concluded that cookies supplemented with germinated fenugreek seed can be stored safely in LDPE at ambient temperature for 2 months without any adverse changes in the organoleptic traits.

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