The International Journal Of Engineering And Science (IJES)
|| Volume || 3 || Issue || 8 || Pages || 40-44 || 2014 ||
ISSN (e): 2319 – 1813 ISSN (p): 2319 – 1805

Development and Quality Evaluation of Unripe Banana Based Sev

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----------**ABSTRACT**----------
The study was conducted to develop Unripe banana pulp based Sev by substituting chickpea flour up to 40 per cent and to examine the physico-chemical and sensory characteristics with respect to storage period. The amount of salt, chilli powder, ajwain and hydrogenated vegetable fat in the formulation should be added at the rate of 2,1,1 and 3 per cent respectively. The fat content of the green banana pulp based Sev was 12.06 per cent less as compared to the control Sev. This is an interesting feature as Sev is basically a fat rich food but the fat content can be reduced by the substitution of chickpea flour with unripe banana. Reduction in fat absorption was because of presence of more Resistant Starch and very less sugar. Resistant starch is shown to improve eating qualities because of its increased expansion, enhanced crispiness and reduced oil pick up in deep fried foods. So, those suffering from Diabetes and Heart diseases can also able to consume this snack. The findings show that by substituting chickpea flour with 40 per cent unripe banana pulp was most suitable and the cost can be reduced by16.24 percent.

KEYWORDS: *Chickpea flour, Fat, Resistant Starch, Sev, Unripe banana.*

Date of Submission: 05 Aug 2014 Date of Publication: 20 August 2014

I. INTRODUCTION

Traditional foods have occupied an unique place in the dietary practices of population in different countries and are known for their unique texture and taste. In traditional foods, Snack foods hold a significant share. Webster's New Ninth Collegiate Dictionary (1985) defines the noun "snack"(first recorded use,1757) as a "light meal, foods eaten between regular meals, food suitable for snacking" and the verb snack as "to eat a snack". **Kulkarni (1992**) stated that snacks which are mostly based on the locally available raw materials, originated probably from a need to overcome the monotony in the diet. In India, traditional foods are prepared at homes and commercial establishments using a cereal, pulses and vegetable combination **(Waghray and Gulla, 2010).**

Demand and consumption of snack foods is increasing day by day. The Indian Snack Market has reached a value of more than US $300 million. It is one of the largest snacks market in the Asia Pacific region.The Government of India approved Rs 740 crore funds for the 12th Plan period for Food Processing Ministry's scheme to facilitate the setting up of units and technology up gradation. Most of the Indian traditional food products are prepared by deep frying. Fats and oils have unique properties including flavour and smooth feeling in the mouth, which improve overall food palatability and acceptability. Some fried products contain large amounts of fat, often reaching up to 40-45% of total product weight. The high oil content is often not essential for product quality and is disadvantageous both the food processor and the consumer. Hence, reducing oil content of these products is an area of interest to researcher **(Priya et al., 1996).**

Legumes have been considered as a rich source of protein throughout the world and contain approximately three times more proteins than cereals. Chickpea *(Cicer arietinum L.)* is one of the top five important legumes on the basis of whole grain production (FAO, 2000). Sev is an Indian traditional snack food, most commonly prepared from chickpea flour. Although, sev is an established snack food in various parts of the country, high cost of the product is a limiting factor in its production. The high cost of the raw material, that is Chickpea flour/soy flour contributes towards final cost of the finished product. The bananas are comparatively cheaper. So to overcome the limitation of cost and higher oil content, the used flour can be partially replaced by unripe bananas. Addition of unripe banana in sev would diversify utilization of unripe banana and add variety to Indian snacks.

India is the largest producer of banana in the world. It occupies around 13.4 per cent area and produces 34.2 million metric tonnes. As banana has low sodium and fat content, it is also consumed by people who are intolerant to salt. It is rich in carbohydrate, antioxidants like dopamine and minerals like potassium and calcium and caters to the calorific need of many developing countries **(Mohapatra et al. 2010a).** The fruit also has antimicrobial and therapeutic properties. It is rich in ascorbic acid (4.5–12.7 mg/100 g fresh mass), β-carotene (50–120 μg/100 g fresh weight), citric acid and malic acid, which can act synergistically as flavour enhancer when added to fruit juices and other finished products **(Mohapatra et al. 2009, 2010a).**

II. MATERIALS AND METHODS

Ingredients used in the development of unripe banana based Sev were of good quality and free from contamination. All the ingredients were procured from the local market of Allahabad. The main ingredients used were Chickpea flour, Green bananas, Salt, Spices (chilli powder, ajwain), Edible vegetable oil and Water. The main equipments used are an electronic weighing balance, sealing machine, soxhlet extractor and Hot air oven. The equipments used were from SHIATS laboratory Allahabad.

2.1 Preparation of Control Sev

Control sample was prepared from soft dough of chickpea flour obtained by adding the requisite of water and fat, salt, chilli powder and Ajwain at the rate of 3g , 3g, 0.5g, 0.5g respectively to 100g of flour and fried by extrusion through a hand operated extruder in to 300 ml of hydrogenated oil at 175 ± 5^{o}C for 45-50 s with turning after few seconds to ensure even frying.

2.2 Preparation of unripe banana based Sev

The main steps used for the preparation of unripe banana Sev were discussed in Fig.1

Weighing of ingredients
↓
Washing (unripe banana)
↓
Steaming (pressure cooker)
↓
Peeling
↓
Mashing
↓
Blending (dry ingredients)
(Chickpea flour, Salt, ajwain, chilli powder)
↓
Mixing 2-3 min
↓
Kneading (3-5 min)
↓
Incorporation in different proportions in the dough
↓
Extruding (with hand Extruder)
↓
Frying (175 ± 5^{o}C for 45-50 s)
↓
Cooling and Packing in HDPE

Fig 1. Flow chart for the preparation of unripe banana based Sev

The fresh, wholesome green bananas were washed with water and then pressure cooked for 3-4 minutes. The bananas: water ratio was 1:3 (w/v). The bananas were kept in chilled water for some time and the peel was then removed and the flesh was mashed in a mixer blender to obtain the banana pulp to be used for product development. Then after banana pulp was incorporated in the formulation for substituting chickpea flour varying from 0 to 50% substitution. The sev thus obtained were subjected to physical and sensory analysis for selecting the appropriate level of banana pulp. After selection of level of the banana pulp, standardization of different ingredients i.e. fat, sail, chilli powder and ajwain was done on the basis of sensory and physical parameters of the prepared sev. The main experimental formulations used in preparation of Sev are given in Table 1.

Table 1. Experimental formulation

Sample code	Chickpea flour(g)	Unripe banana pulp(g)	Salt(g)	Chilli powder(g)	Ajwain(g)	Hydrogenated vegetable fat(g)
S0	100	0	2	1	1	3
S1	90	10	2	1	1	3
S2	80	20	2	1	1	3
S3	70	30	2	1	1	2
S4	60	40	2	1	1	2

2.3 Physico-chemical Analysis

Moisture content, fat content, ash content and texture analysis are the main physicochemical analyses that are observed in this study. All of the above physiochemical analyses were refer from **AOAC (1995).** Some important formulae used are:

$$\#\ \text{Moisture content}(\%)(\text{db}) = \frac{W_1 - W_2}{W} \times 100$$

Where, $W1_{=}$ (Wt. of dish + sample) before keeping in oven (gm).

$W_{2=}$ (Wt. of dish + sample) after keeping in oven (gm).

W = wt. of sample (gm)

$$\#\ \text{Fat Content}(\%) = \frac{(M2 - M1) \times 100}{W}$$

Where, M1 = initial wt. of round flask

M2 = final wt. of flask + fat

W = wt. of sample (gm)

$$\#\ \text{Ash Content}(\%) = \frac{W_3 - W_1}{W_2 - W_1} \times 100$$

Where, W1= weight of empty crucible

W2= weight of crucible and sample

W3= weight of crucible and sample after ashing

2.4 Sensory evaluation of sev

Samples were subjected to organoleptic testing before and after the storage. Organoleptic analysis were carried out in order to determine the various factors like overall acceptability, taste, flavour, colour, aroma etc, and there changes with the number of storage days and parameters. Sensory attributes including color, flavour, texture, taste and crispness of the product will be evaluated by Hedonic Rating Test as recommended by **Ranganna (1986).**

2.5 Statistical analysis

Statistical analysis was done on the data by analysis of variance (ANOVA) on Surface Response Methodology. RSM were used for multivariative variance analysis test at ($p<0.05$). Whenever ANOVA indicated a significant, a pair-wise comparison of means by least significance difference (LSD) was carried out.

III. RESULTS AND DISCUSSION

On the basis of calculation, it was found that as we increased the proportion of unripe banana pulp, the physico-chemical attributes considered in this experiment decreased significantly. The decrease in water requirement may be attributed to high amount of moisture content in banana pulp. By increasing the concentration of unripe banana pulp in formulation of sev preparation frying time and oil uptake also decreased considerably. Similar results were reported by **Sharma et al, (2012).** Reduction in frying time is attributed to high initial dry matter in unripe banana. Green bananas contain 20-22% of dry matter in form of starch. Reduction in fat absorption was because of presence of Resistant Starch. The reduction in oil absorption in fried products with added resistant starch in formulation is due to the fact that resistant resistant starch does not gelatinise at 100°C and does not absorb water. Similar findings were supported by **Vernaza et al, (2011).**Resistant starch has low water holding capacity thus providing good handling and improves texture in final product. Resistant starch is shown to improve eating qualities because of its increased expansion enhanced crispiness and reduced oil pick up in deep fried foods. The result obtained were satisfactory and follow the same trend with the results of **Zaragoza et al, (2010).**

It has been observed that the initial moisture content value of all the samples are 2.96%, 2.83%, 2.75%, 2.66% and 2.54% (S_0, S_1, S_2, S_3 and S_4) and after the storage period of 45 days the moisture content observed are 3.12%, 2.98%, 2.88%, 2.81% and 2.68% (S_0, S_1, S_2, S_3 and S_4). It has been observed that there increase in the moisture content in all the samples. Since, the samples were packed in LDPE from 0 days to 45 days and due to the moisture permeability characteristics of LDPE the table shows increasing trend in the moisture content of all the samples (as shown in Table 2). Moisture content of dough however deccreased with an increase in banana flour concentration in the dough. This may be due to the less water holding capacity of banana starch. Similar results were observed by **Tiboonbun et al. (2011),** who studied the effect of unripe banana flour on physical properties and resistant starch content of rice noodle.

TABLE 2. Moisture content (%) of unripe banana based snack food packed in LDPE during 45 days of ambient storage

Samples	0^{th} day	15^{th} day	30^{th} day	45^{th} day
S_0	2.96	3.00	3.05	3.12
S_1	2.83	2.88	2.93	2.98
S_2	2.75	2.78	2.81	2.56
S_3	2.66	2.71	2.76	2.81
S_4	2.54	2.59	2.63	2.68

On evaluation of result it was found that fat content of the sev decreased considerably, as the proportion of unripe banana was increased from 10% to 40 %. Minimum fat content was found in S_4 (28.11%) in which 40% unripe banana pulp was added. Maximum fat content was found in S_0 (36.88%) in which no unripe banana pulp was added. In sampleS1, S_2 , S_3 and S_4 fat content was found 34.44% , 32.36%, 30.23% and 28.11% respectively in which 10%, 20% , 30% and 40% unripe banana pulp was incorporated.Over all result clearly revealed that the fat content of sev decreased as we increased the amount of unripe banana pulp. The decrease in fat content was due to low absorption of oil and less percent of total fat present in unripe banana. The table shows trend in the fat content of all the samples(as shown in Table 3).

TABLE 3. Fat (%) of unripe banana based snack food packed in LDPE during 45 days of ambient storage

Samples	0^{th} day	15^{th} day	30^{th} day	45^{th} day
S_0	36.88	36.83	36.80	36.78
S_1	34.44	34.40	34.37	34.34
S_2	32.36	32.32	32.30	32.28
S_3	30.23	30.20	30.18	30.16
S_4	28.11	28.08	28.06	28.04

It has been observed that during the storage period from 0 day to 45 days there was very less deterioration in the ash content in control as well as the other treatments (S_0, S_1, S_2, S_3 and S_4). In 0 day the ash content of S_0 sample was 0.49% and after 45 days it was decreased to 0.41%. In other treatments the maximum deterioration was observed in S_3 sample from 0.43 to 0.36 % and S_4 sample from 0.40% to 0.33% (as shown in Table 4.3). It has been observed that the initial value of all the samples are 0.49%, 0.47%, 0.45%, 0.43% and 0.40% (S_0, S_1, S_2, S_3 and S_4) and after the storage period of 45 days the ash content observed are 0.41%, 0.39%, 0.38% ,0.36% and 0.33% (S_0, S_1, S_2 , S_3 and S_4). It has been observed that there was decrease in the Ash content in all the samples. Since, the samples were packed in LDPE from 0 days to 45 days and due to the permeability characteristics of LDPE, shows very minute decreasing trend in the ash content of all the samples.

The texture is an important attribute for any snack food. There was a slight decrease in texture score during storage of the sev packed in LDPE On critical evaluation of the result, during 45 days storage period in LDPE, the highest score for texture was observed for S_0 (0% unripe banana pulp) followed by S_1 (20% unripe banana pulp), S_2 (20% unripe banana pulp), S3(30% unripe banana pulp), and S_4 (40% unripe banana pulp). Anova at 5% showed significant result. The overall results reveal that the texture of sev was slightly unacceptable when the level of incorporation of unripe banana pulp was increased. The texture became hard because of very fine particle size and high cohesive force between them.

Sensory studies

Sensory attributes of unripe banana Sev were evaluated for fresh condition and up to 45 days of ambient storage. Nine point Hedonic rating test method was used for the evaluation of different samples of unripe banana Sev. Different attributes selected were colour & appearance, flavour & taste, body & texture and overall acceptability. The study of sensory attributes were discussed in Table 3.

Table 3. Sensory characteristics of control (T_0) and experimental (T_1, T_2, T_3, and T_4) unripe banana Sev at different intervals during ambient storage.

Samples	Colour & Appearance	Flavour & Taste	Body & Texture	Overall Acceptability
S_0	6.50	7.41	6.74	6.76
S_1	7.00	7.71	7.64	7.12
S_2	7.50	8.12	7.79	7.73
S_3	8.70	8.39	8.79	8.23
S_4	8.00	8.81	8.19	8.60

IV. CONCLUSION

The goal of study was to incorporate green banana pulp for the preparation of a snack food that is sev in order to reduce oil absorption during deep frying and diversify the utilization of green banana. Because fat content and moisture content of the Sev decreased with the increase in the banana pulp incorporation. In addition to this green banana has many health benefits. As we know that India is the largest producer of banana but in Indian market snacks or Sev are prepared mainly from chickpea flour and other grain flours. So in order to reduce the dependence on legume and grain flour and to enhance the utilization of banana, the production of snacks and Sev with incorporation of banana must be encouraged by Indian snack food producers and food industries.

ACKNOWLEDGMENTS

The authors would like to thank Prof. (Dr.) D.M.Denis, Dean, Vaugh School of Agricultural Engineering and Technology, Sam Higginbottom Institute of Agriculture Technology & Sciences (Deemed-to-be-University), Allahabad, India, for providing guidance and all the required facilities and thanks to Er. B.R Shakya, Associate Professor and Head of the Department, Department of Food Process Engineering, Er. Atul Anand Mishra, Assistant Professor and Er. R.N. Shukla, Assistant professor, Department of Food Process Engineering for their constant co-operation, help, guidance and support during project period.

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