

PAPER 106 – INFLUENCE OF STORAGE DURATION AND PACKAGING MATERIAL ON THE QUALITY OF VALUE-ADDED SESAME (*Sesamum indicum*) SEED CANDY

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ABSTRACT

Sesame seed candy is a type of candy that is made by combining sesame seeds and either sugar or honey. These ingredients are then formed into a bar or ball shape through pressing. This study aimed to investigate the effect of storage duration and influence of three packaging material on the quality of value-added sesame seed candy. Sesame seed candy samples were packaged in different materials, including Aluminum Foil Laminated Pouches (AFLP), Low Density Poly Ethylene (LDPE, 400 gauges), High Density Poly Ethylene (HDPE, 700 gauges) and stored for 60 days at room temperature. Proximate analysis, sensory analysis and microbial analysis of the samples were carried out every 5 days. The storability analysis of the sesame seed candies shows that both storage duration and packaging material has influence on the total plate count with p-value less than 0.0001. The longer the duration of storage the more the growth of bacteria. The mold count is only affected by the packaging material. Based on the experimental result, aluminum foil laminated pouches are the best material to package the candy and it will still maintain some of its vital qualities over a period of time.

KEYWORDS: Sesame seed candy, Storage duration, Quality indexes, Deterioration, Packaging materials.

1. INTRODUCTION

Sesame, also known as beniseed, is a flowering plant belonging to the *Sesamum genus*, and it is grown primarily for its edible seeds that develop inside pods. Sesame seeds are among the oldest oilseed crops and contain one of the highest oil contents of any seed. Sesame is widely considered a health food for promoting anti-aging and boosting energy levels.(Obiamaka, 2019). Sesame seeds are a rich source of fat, protein, carbohydrates, fiber, and several minerals. These seeds are widely known for their stability as they can resist oxidative rancidity effectively, even when they are exposed to air for extended periods (Tunde-Akintunde *et al.*, 2012). Sesame seed candy is a confectionary made by compressing sesame seeds with sugar or honey into the form of a bar or ball. It is a well-liked delicacy that is enjoyed across different regions spanning from the Middle East to East Asia, and its texture may vary between chewy and crispy (Richardson, 2002). In Nigeria, sesame seed candy is a popular snack among children. The primary components of this snack include sesame seeds, sugar, honey, and occasionally ginger, lime, orange, lemon, or cinnamon. Sesame seed candy comes in different shapes, such as



Plate 1: Sesame seed candy

cubes, cuboids, and spheres, and is commonly sold by teenage girls on the streets. Plate 1 is an image of sesame seed candy.

The production of sesame seed candy is primarily influenced by two essential factors - the roasting duration and temperature (Fernandez & DeLeon, 2017). Despite its effect on the quality of the candy, the impact of storage duration and packaging material has not been studied. Due to high demand for this product, especially among Nigerian children, and its high consumption rate, research on the shelf life of the product is necessary. This will enable the identification of an appropriate packaging material that can preserve consistent product quality and the acceptable duration for which the product can still be safely consumed.

Usually, sesame seed candy is prepared using three basic ingredients, which are sesame seeds, sugar, and honey. Nevertheless, these ingredients may not suffice to meet the dietary needs of consumers. As a result, fortification of the product is necessary. Candy fortification refers to the process of including vitamins and minerals in commonly consumed candies during processing to improve their nutritional value (Olson *et al.*, 2021). It is a well-established, safe, and economical technique for enhancing diets, preventing and managing micronutrient deficiencies. In this research, ginger and cinnamon have been selected as fortifiers for the production of sesame seed candy.

2. THEORETICAL ANALYSIS

Moisture content is a critical factor that affects the storability of agricultural commodities. High moisture content promotes the growth of microorganisms, leading to spoilage and degradation of quality. Therefore, it is essential to maintain the moisture content within the recommended range for each commodity. The percentage moisture will be calculated using the Equation 1 as given by (Christian *et al.*, 2019). This analysis will be carried out in triplicate and the average value will be recorded and used for moisture content calculation.

$$\% \text{ Moisture} = \frac{W_1 - W_2}{W_1 - W} \times 100 \quad (1)$$

Where;

W = weight of empty crucible

W₁ = weight of sample and crucible before oven drying

W₂ = weight of sample and crucible after oven drying

3. MATERIALS AND METHODS

3.1 Materials

The materials that were used for this research are; Sesame (*Sesamum indicum*) seed, ginger, cinnamon and honey. The materials for this study were purchased from Kure market in Minna, Niger State. The storability analysis was carried out at the department of Food Science and Technology laboratory at Federal University of Technology, Minna.

3.2 Sample Preparation and production of sesame seed candy

The process involves washing of the sesame seed to remove foreign materials, after washing the seeds was sundried to remove the water left. The honey was boiled and the roasted sesame seed was added to the honey syrup. The components were mixed together until a uniform sample was obtained. The prepared sample was allowed to cool and cut into shapes for analysis and sensory evaluation. The candy samples were separated and packed in three packaging materials, the packaged samples were stored at room temperature and at an interval of 5days, the samples were taken out of the packaging materials and analyzed this process continue for 60days. Figure 3.1 is a flow chart showing the different processes involved in the production of sesame seed candy.

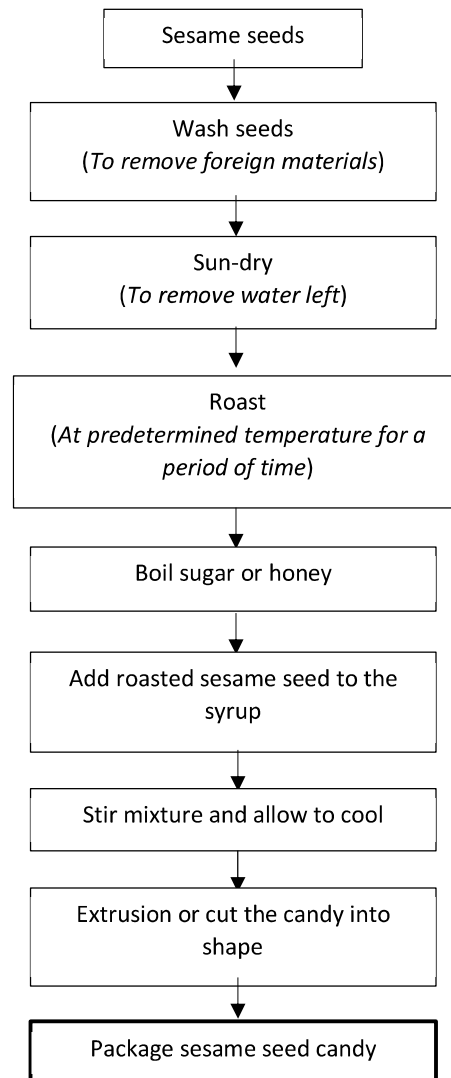


Figure 1: Sesame seed candy production process

3.3 Sensory Evaluation

Sensory evaluation of the samples was carried out every 5 days to determine the acceptability of the candy product. A total of thirty (30) untrained panelist majorly students of Federal University of Technology, Minna was used for the evaluation. The parameters that were evaluated includes; hardness, crispness and overall acceptability. The 9-point hedonic scale was adopted for the evaluation and the resulting data were analyzed. (Sukanya & Michael, 2014).

3.4 Statistical Analysis

In this research work, D-optimal point exchange design was used for a storage of 60 days with three different packaging material. The results obtained were analyzed using Design Expert Software (v13.0). The analysis of variance shows the influence of storage factors (duration of storage and packaging materials) on the candy quality by evaluating its F-value. The greater the F-value, the more significant effect. The significant effect of storage factors to the responses are characterized by p-value “Prob > F” which is less than 0.05.

4. RESULTS AND DISCUSSION

The storability analysis of the value-added sesame seed candy stored for about 60 days are presented in Table 4.1. The table shows the effect of the storage factors on the nutritional properties, microbial growth and sensory parameters, all the data presented are mean of the value obtained during experiment.

Table 1: Effect of factors on the quality of sesame seed candy

S ₁ : Storage Duration	S ₂ : Packaging Materials	Responses							
		Moisture Content	Protein	Vitamin C	Water Activity	Mold Count	Total Plate Count	Hardness	Crispiness
Days		%	%	mg/100g	%	CFU/g	CFU/g		
0	LDPE	4.570	17.250	0.002	8.620	0.0030	0.0000	3.500	5.000
0	HDPE	4.500	18.000	0.002	8.110	0.0040	0.0000	3.500	4.500
0	AFLP	4.460	17.630	0.001	8.310	0.0050	0.0000	4.000	4.500
0	AFLP	4.460	17.630	0.001	8.310	0.0050	0.0000	4.000	4.500
5	LDPE	4.750	17.230	0.002	8.710	0.0034	0.0000	4.000	4.000
5	HDPE	4.410	18.020	0.002	8.110	0.0042	0.0000	4.500	5.000
5	AFLP	4.480	17.610	0.002	8.130	0.0061	0.0000	5.000	4.000
10	LDPE	4.590	17.200	0.001	9.110	0.0040	0.0000	4.500	3.500
10	HDPE	4.620	18.000	0.001	8.070	0.0047	0.0010	4.500	4.000
10	AFLP	3.980	17.610	0.002	9.980	0.0068	0.0010	4.500	4.500
15	HDPE	4.470	17.980	0.001	8.280	0.0050	0.0011	4.000	4.000
15	AFLP	4.730	17.650	0.002	8.630	0.0063	0.0012	4.000	4.000
15	LDPE	4.680	17.180	0.001	9.330	0.0047	0.0016	4.000	4.000
20	HDPE	4.550	17.920	0.001	8.400	0.0055	0.0013	3.000	4.000
20	AFLP	4.980	17.830	0.001	8.710	0.0072	0.0014	3.000	4.000
20	LDPE	4.720	17.180	0.001	9.920	0.0046	0.0016	3.000	4.000
25	AFLP	4.970	17.800	0.001	8.810	0.0074	0.0014	4.500	4.500
25	LDPE	4.830	17.130	0.001	9.880	0.0042	0.0016	4.500	4.500
25	HDPE	4.590	17.720	0.001	8.450	0.0053	0.0017	4.000	4.500
30	HDPE	4.630	17.700	0.000	9.380	0.0048	0.0016	4.500	4.500
30	AFLP	5.040	17.630	0.000	8.820	0.0074	0.0016	4.000	4.500
30	LDPE	4.890	17.180	0.000	10.110	0.0050	0.0021	4.500	5.000
35	LDPE	5.060	16.150	0.000	10.240	0.0050	0.0015	4.000	4.500
35	AFLP	5.840	17.630	0.000	8.910	0.0075	0.0015	4.000	3.500
35	HDPE	5.710	17.080	0.000	10.980	0.0053	0.0027	4.500	4.000
40	AFLP	5.860	17.640	0.000	8.940	0.0069	0.0012	3.500	4.000
40	LDPE	5.490	16.000	0.000	11.210	0.0047	0.0018	4.000	4.000
40	HDPE	5.980	17.060	0.000	10.440	0.0043	0.0029	3.500	4.000
45	AFLP	5.860	17.610	0.000	10.000	0.0060	0.0013	4.000	4.500
45	LDPE	6.040	16.000	0.000	11.920	0.0050	0.0021	3.500	3.500
45	HDPE	6.980	17.000	0.000	11.240	0.0049	0.0030	4.000	4.000

50	AFLP	5.910	17.610	0.000	10.080	0.0042	0.0015	3.500	4.000
50	LDPE	6.930	15.980	0.000	13.140	0.0057	0.0028	4.000	4.000
50	HDPE	7.320	16.630	0.000	11.880	0.0040	0.0033	4.000	4.000
55	LDPE	6.970	15.330	0.000	14.720	0.0053	0.0021	4.000	4.500
55	AFLP	6.000	17.550	0.000	10.120	0.0038	0.0029	4.500	4.000
55	HDPE	7.480	16.600	0.000	12.110	0.0043	0.0033	4.000	3.500
60	LDPE	6.990	15.300	0.000	14.800	0.0053	0.0021	4.000	4.000
60	AFLP	5.920	17.500	0.000	12.250	0.0043	0.0029	4.000	4.000
60	HDPE	7.500	16.550	0.000	12.140	0.0045	0.0033	4.000	4.000

4.1 Effect of storage duration and packaging material on the quality of sesame seed candy.

The result shows that moisture content is significantly affected by storage duration and less affected by packaging materials with p-value less 0.05. However, moisture content tends to increase during storage period. Aluminum Foil Laminated Pouches gives the least moisture content of 3.98% while High Density Poly Ethylene gives the highest moisture content of 7.50% (Borchani *et al.*, 2010).

The effect of the storage condition on the protein value of the sesame seed candy is also presented in Table 4.1, the analysis of variance shows that the packaging material significantly affect the protein value of the candy with p-value less than 0.05. The result also shows that the packaging material that give high protein value is the high density poly ethylene (700 gauges) while low density poly ethylene (400 gauges) give the lease protein value. Sesame seeds is a good source of protein and a source of energy with rich assortment of minerals (Neha & Nandita, 2012).

For the vitamin C value, the result show that storage duration significantly affects the vitamin C value of the candy while the packaging material is less significant with a p-value greater than 0.05. The result also indicates that the value of vitamin C decrease consistently this may be due to exposure to oxygen during storage, trapped air in the packaging material can cause the Vitamin C value to decrease (Alvarez-Suarez *et al.*, 2015), beyond the 30th day vitamin C value were lost hence to maintain the vitamin C value the candy has to be store not beyond 30 days.

Both storage duration and packaging material significantly influence the water activity of the candy. From Table 4.1, the longer the storage duration the increase in water activity. Low density poly ethylene gives the highest water activity value of 14.8% while high density poly ethylene give the least water activity value of 8.07%.

The mold count is affected significantly by the packaging material. The storage duration does not have much influence on the bacteria growth. From Table 4.1, it is best to store the candy on low-density poly ethylene (400 gauges) as it gives the least mold count. Storing the candy on Aluminum foil laminated pouch will cause bacteria to grow and that could deteriorate the candy sample. Both storage duration and packaging material influence the total plate count. The longer the duration of storage the more the growth of fungi. Storing the candy on high density poly ethylene will encourage fungi growth as can be seen on Table 4.1. The said packaging material give a total plate count of 0.0033CFU/g.

From the Table it can be seen that the storage duration significantly affects the hardness of the candy, while packaging materials has no effect on the hardness. The longer the storage duration the harder the candy becomes. While both the storage duration and packaging materials do not have any significant effect on the crispiness of the candy. Crispiness is associated with higher pitch sound made while eating a candy, it is important in candy acceptability. Thus, the food industry has to consider the necessity to control this characteristic both during production and storage (Roudaut *et al.*, 2002). Low Density Poly Ethylene material gives the lowest crispness of 3.500.

5. CONCLUSIONS

Sesame seed candy is one of the snacks that is highly consumed by children and adult in remote part of Nigeria. Knowing the quality of this candy and understanding the factor that influence its quality becomes significant. The storability analysis of the sesame seed candies also shows that both storage duration and packaging material has influence on the total plate count with p-value less than 0.0001. the longer the duration of storage the more the growth of bacteria. The mold count is only affected by the packaging material. Based on the experimental result, aluminum foil laminated pouches are the recommended material to package the candy and it will still maintain

some of its vital qualities over a period of time. Future studies can investigate the effect of other packaging materials and storage conditions on sesame seed candy quality.

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