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Sensory evaluation of pulverized okra (*Abelmoschus esculentus* L. Moench) preserved by local techniques

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ABSTRACT

Aim: The study was carried out for sensory evaluation of pulverized okra (Abelmoschus esculentus L. Moench) preserved by local techniques.

Materials and Methods: A panel of tasters comprising students of the Yaba College of Technology, Yaba, Lagos State, Nigeria was setup as judges for the okra product preference assay conducted using the 9-point hedonic scale. A completely randomized design [CRD] was adopted during the administration of the prepared okra samples with double product blind fold to avoid bias.

Results: The panel of tasters unanimously agreed that there was no significant difference in the taste, sliminess (mucilage or rheological properties) and acceptability of okra samples stored on the shelve, preserved either by sun-drying (Taste [Ila-Iwo (8.2±1.0)], Sliminess [Ila-Iwo (8.1±0.6)], and Acceptability [Ila-Iwo (7.9±0.9)], respectively) or oven drying (Taste [Kubewa (8.2±1.0)], Sliminess [Kubewa (8.3±1.1)], and Acceptability [Kubewa (8.0±1.1)], respectively) and those stored in the cupboard, preserved either by sun-drying (Taste [Ila-Iwo (8.2±0.9)] and Sliminess [Ila-Iwo (7.5±1.0)], respectively) or oven drying (Taste [Kubewa (8.3±1.3)], Sliminess [Kubewa (7.8±1.4)], and Acceptability [Kubewa (7.8±1.4)], respectively) compared to the fresh okra samples used as control for the experiment [sun-drying (Taste [Ila-Iwo (6.7±1.3)] and Sliminess [Ila-Iwo (7.2±1.7)] or oven drying (Taste [Kubewa (7.1±1.4)], Sliminess [Kubewa (7.9±1.3)], and Acceptability [Kubewa (7.6±1.3)], respectively)].

Conclusion: It was concluded that preservation and storage techniques used in the study were able to sustain the quality, rheological properties and the palatability of okra even after a very long period of storage.

Keywords: Aroma, Hedonic scale, Rheological properties, Storage techniques, Taste.

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Introduction

In most modern markets around the world, there exist serious competition among manufacturers of food products due to consumers tailored specifications or desires or preference for a particular type of diet (e.g. products for vegetarians or flesh eaters), or product quality (e.g. foreign or locally manufactured food products) or brand (e.g. bestselling or popular food labels) or taste (e.g. from home-made or commercial recipe, intercontinental or local cuisine) or flavour (e.g. natural or artificial [synthetic] flavours) or texture (e.g. fine or coarse food texture) or even appearance (e.g. cake designs to entice kids or impress teens or cajole adults or even multipurpose design for all age groups or occasion) etc. Yet, consumers are still insatiable and manufacturers must develop new strategies to persuade their customers.

Price of food commodities too can also play an important role in decision making for some consumers. Recently, there seems to exist a new challengefor the food industry based on the increasing public interest in the availability of "natural" or "healthy" food ingredients where only organic materials are used (Alba, 2015). For instance, replacement of gelatin (animal origin) that has been utilized for structuring of confectionery products over decades or the elimination of synthetic surfactants (e.g., Tweens) from formulations of food emulsions are some examples of these demands (Alba, 2015).

Therefore, to keep up with the unending demands of billions of consumers all over the world, the quality of food products need to be

preserved regardless of the preservation techniques used(Etaware and Etaware, 2019a). Drying of food materials is an effective method of extending the longevity or shelf-life of the preserved products (Etaware and Etaware, 2019b) but the quality of such food materials during drying depends not only on the initial quality of the raw materials, but also on the processing conditions during drying (Karel, 1991).In the process of drying, several physical and structural changes occur simultaneously (Senadeera, 2009).Due to the increase in the demand for fresh fruits and vegetables, there is a need to develop improved methods for maintaining and sustaining product quality (Tsado, 2015). So, in order to extend the shelf life of some vegetables such as okra, it is essential to preserve and package it appropriately in order to reduce its rate of respiration and therefore decrease okra pod perishability level (Nuguyen *et al.* 2004). But, some consumers of okra still prefer freshly harvested okra pods to the preserved alternatives. The problems of loss in quality, mucilage rheological properties and limited shelf life are major setbacks in the marketing of fresh okra in Nigeria (Etaware and Etaware, 2019a) due to its high respiratory rate and increased perish ability index (Tsado, 2015).

In Nigeria, okra is grown in the wet/rainy and dry seasons, but it attracts higher profit during the dry season when the demand is often in excess of the limited supply (Tsado, 2015) and the storage conditions are quite unfavourable for extending the longevity of okra pods. Therefore, this research was intended to sample the opinion of okra lovers in Lagos, Nigeria in other to determine if the preserved product quality, texture, taste, flavour and the rheological properties of the okra mucilage was indeed sustained by the initial preservation techniques employed by Etaware and Etaware (2019a) and if there was indeed no significant difference between the freshly harvested okra pods and the preserved okra.

Materials and Methods

Preservation of okra

The preserved pulverized okra samples used for this experiment were prepared in the Food Technology Laboratory of the Department of Food Technology, School of Basic Technology, Yaba College of Technology, Yaba, Lagos, Nigeria by Etaware and Etaware (2019a).

Experimental layout for sensory evaluation

A completelyrandomized design [CRD] was adopted in the administration of the prepared okra samples with double product blindfold to avoid bias or influenced judgementby the panel of tasters.

Administration of okra samples to the panel of tasters

The okra product preference assay was conducted using the 9-point hedonic scale criteria as described by Wichchukit and O'Mahony (2015). The panel of tasters constituted for this research was basically students of the Yaba College of Technology, Yaba, Lagos State, Nigeria who were lovers and regular consumers of okra. Sensory evaluation involved the use of physical and chemical characteristics of food as perceived by the sense organs of human beings to measure the quality of food. The parameters that were examined by the board of tasters acting as biosensors and bio-actuators are: Aroma, Appearance, Taste, Sliminess and Overall Acceptability.

The reconstitution of the preserved powdered okra sample used for this experiment was done by mixing 25g of the pulverized okra samples with 250mL of water; the mixture was made to boil at 100^{o}C for 3mins. The samples were seasoned and spiced equally to make it more palatable for consumption, while reconstituted okra samples added to soups (as supplement to enhance fluidity) were added in equal proportion to the same volume of soup and categorized separately. The cooked samples was aseptically transferred into clean ceramic dishes and allowed to cool before each tasting session. The panel of tasters consists basically of ten (10) judges and a brief orientation was necessary to explain the terms used to describe the different attributes of the prepared okra samples. Each panellist was allowed to examine, savour and consume all the samples displayed and his/her observation(s) was recorded as a verdict hinged on the hedonic scale.

S/N	Sensory Attributes	Grade	Score
1	Positive	Like extremely	1
2		Like very much	2
3		Like Moderately	3
4		Like slightly	4
5	Neutral	Neither Like nor Dislike	5
6	Negative	Dislike slightly	6
7		Dislike moderately	7
8		Dislike very much	8
9		Dislike extremely	9

Data Analysis

The data generated from the observations made by the panel of tasters were categorized, analysed (descriptive analysis) and represented as means in different tables using SPSS version 20. Inferential statistical analysis was conducted using COSTAT 6.451 analytical software and the homogeneity of statistically significant means was determined using Duncan Multiple Range Test (DMRT) at P≤0.05. Graphs and figures were extrapolated from Microsoft Excel Workbook 2010 service pack.

Results

There was no significant difference in the taste, sliminess (mucilage or rheological properties) and acceptability of okra samples stored on the shelve, preserved either by sun-drying (Taste [Ila-Iwo (8.2±1.0)], Sliminess [Ila-Iwo (8.1±0.6)], and Acceptability [Ila-Iwo (7.9±0.9)], respectively) or oven drying (Taste [Kubewa (8.2±1.0)], Sliminess [Kubewa (8.3±1.1)], and Acceptability [Kubewa (8.0±1.1)], respectively) and those stored in the cupboard, preserved either by sun-drying (Taste [Ila-Iwo (8.2±0.9)] and Sliminess [Ila-Iwo (7.5±1.0)], respectively) or oven drying (Taste [Kubewa (8.3±1.3)], Sliminess [Kubewa (7.8±1.4)], and Acceptability [Kubewa (7.8±1.4)], respectively) compared to the fresh okra samples used as control for the experiment [sun-drying (Taste [Ila-Iwo (6.7±1.3)] and Sliminess [Ila-Iwo (7.2±1.7)] or oven drying (Taste [Kubewa (7.1±1.4)], Sliminess [Kubewa (7.9±1.3)], and Acceptability [Kubewa (7.6±1.3)], respectively)] as showed (Table 2).

The panellists unanimously agreed that there were significant difference (P≤0.05) in the appearance of the preserved okra samples (excluding Ila-Iwo okra samples that were preserved by sun-drying and stored in the cupboard [7.6±1.5]) compared to the fresh sample [6.4±2.2] as showed (Table 2). Also, the panellists adjudged the aroma of the preserved okra samples as statistically significant (P≤0.05) from that of the fresh okra samples.

Table 2: The sensory evaluation of fresh and preserved okra powder

Duration	Preservation	Method	Storage	Variety	Appearance	Aroma	Sliminess	Taste	Acceptance
0 Month [Fresh]	Natural	Sun-dried	None	Kubewa	3.5±2.4^{e}	5.6±1.8^{e}	5.6±2.0^{b}	5.0±3.0^{c}	5.3±1.9^{c}
				Ila-Iwo	6.4±2.2^{b-d}	6.0±2.4^{de}	7.2±1.7^{a}	6.7±1.3^{b}	6.8±1.5^{b}
	Artificial	Oven-dried		Kubewa	6.4±2.5^{b-d}	6.2±2.3^{c-e}	7.9±1.3^{a}	7.1±1.4^{ab}	7.6±1.3^{ab}
				Ila-Iwo	5.7±2.0^{d}	6.1±1.9^{de}	4.8±2.8^{b}	5.2±2.7^{c}	5.4±2.0^{c}
1 Month [Preserved]	Natural	Sun-dried	Shelve	Kubewa	8.7±0.5^{a}	7.9±0.6^{ab}	7.7±1.1^{a}	8.2±0.6^{ab}	7.9±0.9^{ab}
				Ila-Iwo	8.2±0.8^{a}	8.8±0.4^{a}	8.1±0.6^{a}	8.2±1.0^{ab}	7.9±0.9^{ab}
	Artificial	Oven-dried		Kubewa	8.3±1.1^{a}	7.7±0.5^{ab}	8.3±1.1^{a}	8.2±1.0^{ab}	8.0±1.1^{ab}
				Ila-Iwo	7.7±0.7^{ab}	8.5±0.5^{ab}	8.4±0.7^{a}	8.3±0.8^{a}	8.3±0.7^{a}
	Natural	Sun-dried	Cupboard	Kubewa	6.1±2.3^{cd}	7.1±1.4^{b-d}	7.5±1.4^{a}	8.4±0.8^{a}	8.3±0.8^{a}
				Ila-Iwo	7.6±1.5^{a-c}	8.3±0.8^{ab}	7.5±1.0^{a}	8.2±0.9^{ab}	8.2±0.9^{a}
	Artificial	Oven-dried		BYD	8.2±0.8^{a}	7.5±1.6^{a-c}	7.8±1.4^{a}	8.3±1.3^{a}	7.8±1.4^{ab}
				SOP	8.3±0.7^{a}	7.9±1.2^{ab}	7.9±0.7^{a}	7.4±1.2^{ab}	8.1±1.2^{ab}

Means with the same alphabets down the COLUMN are not significantly different at P<0.05 using Duncan Multiple Range Test (DMRT) for separation of statistically significant means. Data collected were represented as "Means ± SD" only

Discussion

The panel list unanimously agreed that the taste, general acceptance and sliminess or mucilage forming properties of the preserved okra samples were similar to that of the freshly prepared okra. This showed that the preservation and storage techniques used in this study was able to sustain the quality, rheological properties and the palatability of okra even after a very long period of storage. The achievements made by this research will help reduce the use of chemical preservatives and other inorganic or synthetic substances in the packaging of okra and other food materials, thereby, reducing the risk and chances of chemical poisoning and other induced ailments/infections acquired by consumption of chemicals. This will also help to ameliorate the problem of over-dependence on chemicals for

protection of food crops which is fast endangering the lives of beneficial microbes (the flora and fauna community) in the environment and ultimately distorting the normal functioning of the ecosystem. The research findings was in line with the report of Tsado (2015) who stated that there was no significant difference in the taste and other principal qualities of sun- and oven-dried okra samples compared to the fresh samples as adjudged by a group of panellists.

Conclusion

The preservation and storage techniques used in this study were able to sustain the quality, rheological properties and the palatability of okra even after a very long period of storage. The achievements made by this research will help reduce the use of chemical preservatives and other inorganic or synthetic substances in the packaging of okra and other food materials, thereby, reducing the risk and chances of chemical poisoning and other induced disease infections such as cancer etc. acquired by consumption and accumulation of chemical elements and heavy metals in the body system.

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