

Original Research Paper

Effect of Method of Drying Okra Fruits (*Abelmoschus esculentus*) on Proximate Composition of the Dried Product

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Fresh okra fruits are used as vegetables all over Nigeria and Africa. They are used as fresh vegetable fruits, but better as dried products as they are of great importance and delicacy for people, especially to provide proper nutrients for those times when the products are not fresh in season. Its seasonality means that its availability is limited to those lean periods of the year when they cannot be available as fresh, but its re-composition from the dry state does not mean its nutritional quality has changed drastically. This study was carried out to determine the effect of method of drying of okra on the nutritive and sensory qualities of the dried products. Three drying methods were adopted before the determination of the proximate composition and sensory characteristics of dry okra. The study was carried out at the School of Agriculture and Agricultural Technology of Federal University of Technology, Gidan Kwanu, Minna, Nigeria. The obtained results showed that, direct sun dried sliced okra fruits produced the best dry quality, followed by close sun drying method while oven drying of okra achieved the least acceptance.

Keywords: Dried Okra, Tsuku, Shelf life, Proximate composition.

INTRODUCTION

Post-harvest handling refers to a successive handling of products after harvesting. It peaks at the position where consumers judge the products to either be acceptable or rejected. They may be either in packaging, individual unit quantities and qualities or pricing (Kader, 2000). Okra (*Abelmoschus esculentus*) is one of such flowering plants in the mallow family (Malvaceae), originating in tropical and subtropical Africa that is used for food (Tindal, 1993). It was formerly considered a species of hibiscus, but now classified in the genus *Abelmoschus*.

The word okra is of an African origin and means “*lady’s fingers*” in Igbo, a language spoken in the eastern Nigeria. Okra is mainly cultivated for its “pod” which is cooked and eaten in countries like Sudan, Egypt, Ghana, Cameroon and Nigeria. It is also important in other tropical areas including Asia; Central and South America.

In Nigeria, okra is grown in both the wet and dry seasons, but it attracts higher profit during the dry season when the demand is often in excess of the limited supply. Fresh okra fruits are used as vegetable while the roots and stems are used for preparing “gur” or brown sugar (Chauhan, 1972), okra seeds may yield vegetable oil. To extend shelve life, okra fruits

are dried after they have been sliced or chopped into bits and pieces.

PROBLEM STATEMENT

Due to the increase in demand of fresh fruit and vegetables, there is a need to develop improved methods for maintaining product quality. Loss in quality and limited shelf life are problems faced in the marketing of fresh okra in Nigeria due to its high respiratory rate and consequently perishability. In order to extend the shelf life of okra, it is essential to package it in appropriate wrapping to reduce its rate of respiration and therefore perishability (Nuguyen *et al.* 2004).

JUSTIFICATION FOR STUDY

The effect of some drying methods on drying of okra has been studied by many researchers, but there appears to be little information on method of drying on the proximate composition of dry okra powder – called (*kpankawu* in Gwari; *tsuku* in Nupe; *orunla* in Yoruba or *busashan kubewa* in Hausa). This study was aimed at drying okra fruits using three methods;

(i) oven; (ii) open sun drying and (iii) an improvised Solar drying – drying in a covered white cellophane enclosed chamber, for the prolongation of shelf life and the effect of these drying methods on proximate composition of dried okra.

MATERIAL AND METHOD

The study involved a field and laboratory work conducted at Gidan Kwanu, campus of Federal University of Technology, Niger State, in 2013.

Source of okra fruit samples and their drying methods

The okra fruits used in the study were sourced from the Monday market at Kaduna, in Kaduna State and the main Gidan Kwanu market at Gidan Kwanu village, Minna in Niger State. Freshly harvested fruits from these locations were bought into the Laboratory of the Crop Production Department, School of Agriculture and Agricultural Technology, Federal University of Technology, Minna, Niger State, where they were washed with clean water and chopped into smaller disc shaped pieces, then carefully transferred into containers ready for drying tests using the three drying methods i.e (i) oven drying; (ii) open sun drying and (iii) an improvised Solar drying. Initial weights were taken, then carefully placed in sun and monitored until a constant weight measurement was reached. Both towns of Kaduna and Minna are in the central equatorial zone -guinea savannah part of Nigeria (Ojanuga, 2006).

Parameters collected

The parameters considered for collection were; (i) percentage moisture content; (ii) viscosity (sliminess); (iii) fresh and dry fruit colours along with (iv) sensory qualities - tastes.

Protein Determination

Protein content was determined using the macro Kjeldahl method as described by AOAC (2005). The equation recorded below was used to arrive at this parameter.

$$\%N = \frac{\text{Titra mass of N value} \times \text{MHCL used} \times \text{AN}}{\text{Weight of sample}} \times 100 \quad \dots\dots\text{Equation 1}$$

$$\% \text{ crude protein} = \% \text{ Nitrogen} \times 6.25$$

Where;

N = Nitrogen

MHCL = Molarity of HCL

AN= Atomic mass of nitrogen - 14

Ash Determination

Ash content was determined according to the method described by AOAC (2005). The equation listed below was also used to work out this parameter.

$$\text{Ash content \%} = \frac{\text{weight of ash}}{\text{original weight of sample}} \times 100 \quad \dots\dots\text{Equation 2}$$

Fat Content

The fat content was determined using the Soxhlet solvent extraction method outlined in AOAC (2005). The flask was weighed and percentage fat was calculated as follows:

$$\text{Fat \%} = \frac{W_1 - W_0}{W_1 \text{ of sample taken}} \times 100 \quad \dots\dots\dots\text{Equation 3}$$

Where

W_0 = weight of dry glass

W_1 = weight of glass + oil

Crude Fibre Content

Crude Fibre was determined by the procedure in AOAC (2005). The equation listed below was used to work out values for this parameter.

$$\text{Fibre(\%)} = \frac{W_1 - W_2}{\text{Weight of sample}} \times 100 \quad \dots\dots\dots\text{Equation 4}$$

Where

W_1 = initial weight of sample

W_2 = final weight of sample

Determination of Carbohydrate

The procedure outlined in AOAC (2005) was used in determining the carbohydrate content of the samples. This was calculated using the under-listed equation.

$$\text{Carbohydrate (\%)} = 100 - (\%P + \%F + \%A + M) \text{ by difference} \quad \dots\dots\text{Equation 5}$$

Where;

P = Protein

F = Fat

A = Ash

M = Moisture.

Sensory Evaluation of the Dried Fruits

Oven dry, sun-dry, and closed sun dry okra fruits were evaluated for aroma, taste, sliminess, pre-colour, post-colour, and overall acceptability of their cooked products (soup) by thirty five tasters as described by Ihrkoronye and Ngoddy (1985). The samples were evaluated on a grading scale 1 - 5: where 1-dislike very much; 2-dislike slightly; 3-Neither like nor dislike; 4-like slightly and 5-like very much).

Data Analysis

All data collected was subjected to descriptive statistical analysis. The computer statistical software Minitab Release 14 was used to perform the analysis. Graphs were used to reveal salient observations.

RESULTS AND DISCUSSION

Content of crude protein of the dried okra

The results from the crude protein content of samples of the locations (Niger and Kaduna States) were significantly different between each other. Although the oven drying method of okra samples from Niger State was higher in value than okra from Kaduna, but the Kaduna okra was higher in values using sun drying method than the Niger okra. Okra from Niger State was higher in protein when closed sun drying method was used. This result is presented in Fig.1.

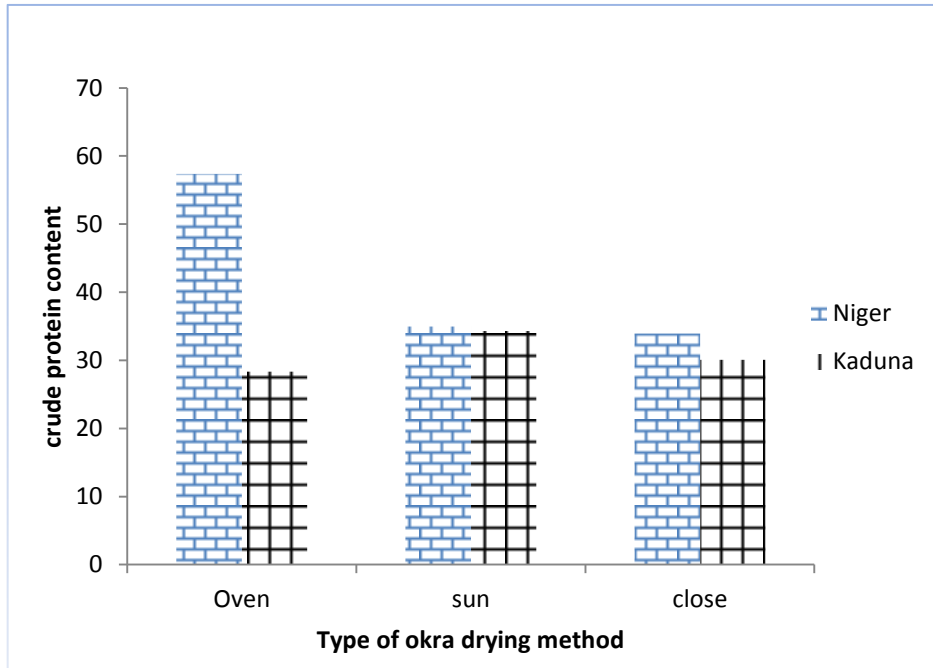


Fig. 1. Difference in crude protein content of green okra fruits as affected by method of drying.

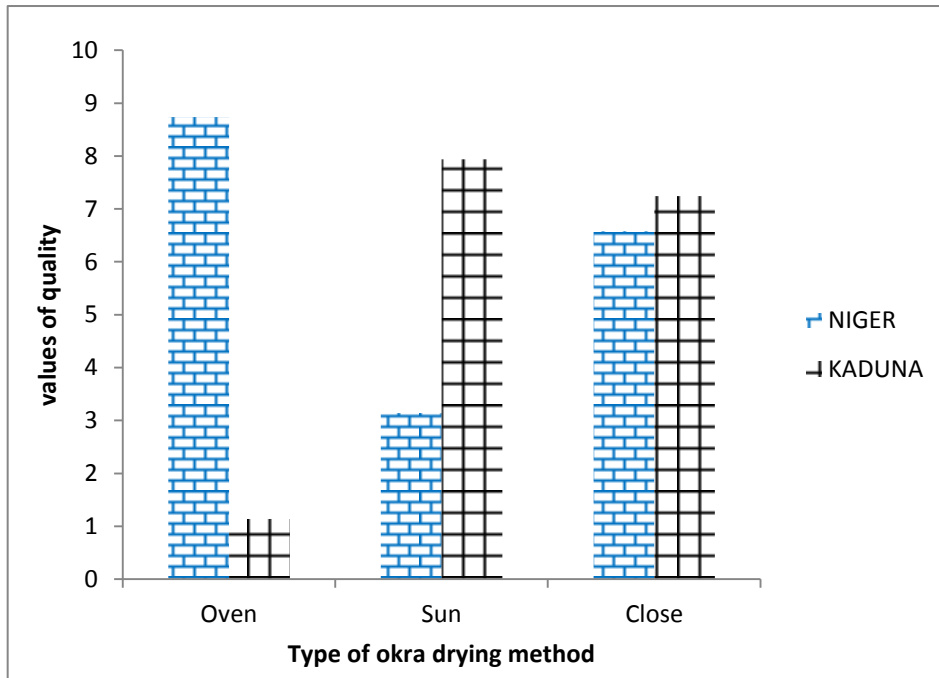


Fig. 2. Difference in lipid content of green okra fruits as affected by method of drying

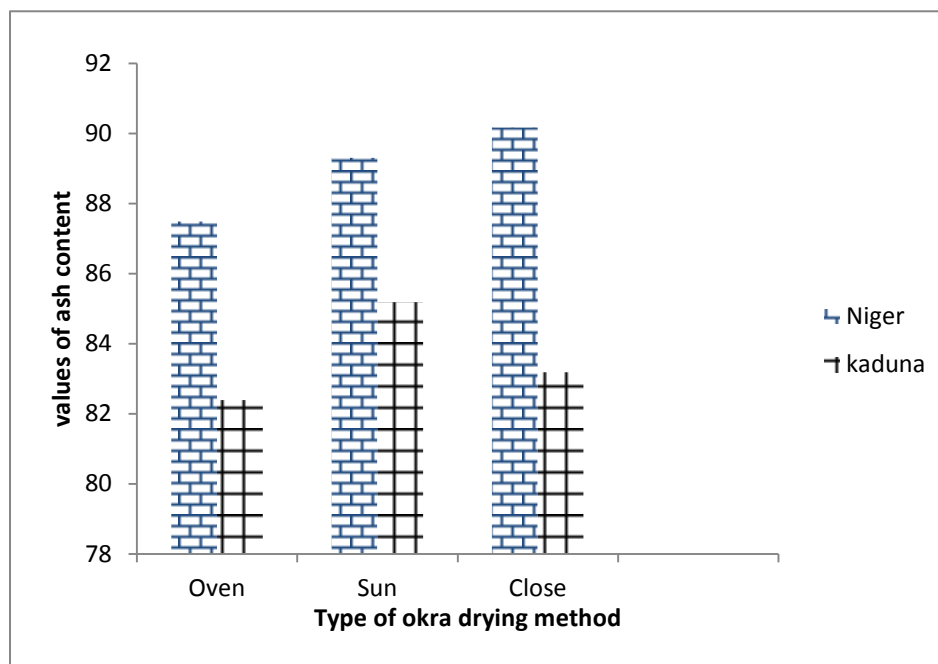


Fig. 3. Difference in ash content of dried okra as affected by method of drying

Crude lipid of dried okra

The result of the analysis of variance – ANOVA, for crude lipid showed that there was a significant difference between the samples. Okra samples from Niger state that were oven dried had higher values than that from Kaduna State that was also oven dried. Samples from Kaduna state also sun dried was equally higher in value than that from Niger State that sun dried okra. Okra sample from Kaduna state that was close sun dried was higher than close sun dried okra from Niger State.

Ash content of dried okra

Result of the analysis of variance - ANOVA for ash content shows a significant difference between the sampling locations - Niger and Kaduna States. In all the drying treatments, the closed sun drying method produced the highest ash content followed by the open sun drying treatment. The oven drying method produced the least ash content.

This result is in agreement with work of Satwase *et al.*, (2012), who, while working with processed Moringa leaves reported significantly higher values for leaves dried in the shade compared to those leaves dried in the sun. Like in this study also, the ash content values ranged between 84 to 92 percent.

Carbohydrate content of dried okra

Result of the carbohydrate content of the two locations dried in the three different methods showed no significant difference. Although values for samples from Niger state that had been oven dried were little higher than samples from Kaduna state the result was not statistically significant.

Result of the proximate analysis of solar dried vegetables had significantly ($P < 0.05$) higher carbohydrate, protein, fat,

ash and fiber content than the sun dried vegetables. They also showed that mineral content (P, K, Ca, Mg and Na) and vitamins contents (vitamin A and C) of solar dried vegetables were also significantly higher ($P < 0.05$) than sun-dried samples.

Evaluation of sensory quality

Aroma

Result for aroma showed no significant difference between the two locations of sampling. In terms of means, okra sample from Niger State was higher in aromatic than that from Kaduna State. There was a significant difference between the oven dry okra and those close sun-dried but the highest aroma was from the sun-dried okra.

Taste

The result of the analysis of variance showed no significant difference between the two locations of sample. Based on the locations, there was no significant difference between the two locations. Based on the individual means of treatments, showed in the analysis, there was significant difference between oven drying of okra and close sun drying of the okra. There was also no significant difference between sun drying and close sun drying of the okra in terms of taste.

Sliminess

The result of the analysis of variance showed significant difference between the two locations of the samples. There was a significant difference between the oven dried okra; sun-dried okra and closed sun drying okra. And there is also

significant difference between sun drying and close sun drying okra. Close sun drying was better in terms of sliminess.

Pre and Post colour of dried okra slices

The result of the analysis of variance that there is no significant difference between the two locations of sample. In terms of location of sample there is significant difference between the sample. Base on treatment of the sample, there is significant difference between oven dry okra and sun drying and close sun drying okra. And there is also no significant difference between sun drying and close sun drying okra.

Colour

The result of the analysis of variance – Two way ANOVA for post colour of okra showed that there is significant different between the two locations of sample. In terms of location of sample, there is significant difference between oven drying okra and close sun drying okra. There is also significant difference on close sun drying and sun drying okra. So sun drying is better in terms of colour.

Discussion

Okra is highly perishable because of its high moisture content and respiration activities; thus it is necessary to preserve the commodity by prolonging its shelf life. The intermediate method of preserving okra involves slicing and sun drying of the fruits to improve its keeping quality (FAO, 2003). This study has looked at the quality of fruits grown in two locations – Kaduna State and Niger State.

The result of locations showed that, Base on Taste, there is significant difference between the two location. And base on Aroma, there is no significant different between the two locations. Base on Sliminess, there is significant difference between the two locations. Based on pre colour, there is no significant different between the two locations. Base on post colour, there is significant difference between the two locations of the sample.

Sun dried okra can then be milled grinded to convert into powder form for later use. Although sun drying may be cheap, its drawbacks are well documented in literature (Doymaz 2005). Therefore, an effective means of overcoming these problems is to dry okra with sun or oven (Doymaz and Pala, 2002). Close sun drying still uses the sun as the heat source, but is specially designed to effectively use sun drying temperature and air current in the event of a poor weather conditions. It is, therefore, an effective means of overcoming these adverse situations in drying okra while at the same time keeping its culinary quality.

CONCLUSION

Sensory evaluation of food products is an important criterion by which consumer acceptability can be assessed. The sensory evaluation test on the six okra samples did not show any significant difference between the methods of drying okra fruits, although oven dried okra appeared darker than the sun drying. Based on these findings the following recommendations are made.

RECOMMENDATION

The sun drying operation such as slicing is recommended. This reduced the drying time, therefore, preventing the loss of vitamin C from the vegetables. Slicing should be uniform to ensure uniform drying time and retention of nutrient.

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