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Proximate, Functional, and Sensory Properties of Dried Okra (*Abelmoschus esculentus* L. Moench) Slices

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ABSTRACT

Drying is a widely recognised preservation technique used to reduce the perishability of vegetables such as okra. A comprehensive evaluation is needed to assess how different drying methods affect okra's proximate composition, functional properties, and sensory attributes. Research indicates that drying significantly influences these qualities, with methods like freeze-drying or hot air drying at specific temperatures showing better preservation of nutritional and functional properties compared to other methods. The purpose of this study is to close this knowledge gap by thoroughly evaluating the nutritional composition and sensory qualities of dried okra, which will help to better comprehend its potential as a preserved food product. After being cleaned with clean water, the okra samples were pre-treated for 30 seconds in boiling water. Three portions of the samples were then separated, cut into pieces that were 4 mm thick, and dried at 50 and 60 degrees Celsius. Every analysis was conducted using accepted practices. The proximate composition of the dried okra slices varied significantly ($p<0.05$) among the three drying techniques, with the exception of the fibre content, which stayed mostly constant. The highest emulsion (48.39%) and swelling (41.38%) capacities were recorded in the sample which was dehydrated at 50°C. Oven drying at 50°C produced the maximum emulsion stability (38.66%). The most effective method was drying at 50°C with a dehydrator for preserving the functional and nutritional properties of okra, with oven drying at 60°C and solar drying performing less well, especially in emulsion stability and swelling capacity. Sensory tests also showed a strong preference for oven dried and dehydrator dried okra compared to the solar dried okra, suggesting the dehydrator method produces a superior product.

Keywords: Dehydrator, functional, okra, oven drier, proximate, sensory, solar drier

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INTRODUCTION

Okara (*Abelmoschus esculentus* L. Moench) is a highly valued vegetable that is grown all over the world because of its many culinary uses and rich nutritional profile. More of a diet food than a mainstay is okra (National Research Council, 2006). Okra, a vegetable widely cultivated in tropical and subtropical regions, is a nutritional powerhouse with numerous health benefits. Okra is a good source of vitamins A, C, K, and B6. Vitamin A, derived from beta-carotene, is crucial for healthy vision and skin. Vitamin K is essential for bone health and blood clotting (Daniluk, 2020). Okra known as *Ila* (Hussein et al., 2018).

Okra is well known for having a lot of vital nutrients. Having a sticky mucilage that promotes better digestion, it belongs to the Mallow family and used to treat stomach ulcer, gastritis, and liver and gall bladder cleansing (Dailuk, 2020). On a small scale, okra seeds are used to produce oil, and the fatty components enhance the nutritional and sensory qualities of nearly every diet (Vermerris & Nicholson 2020).

Dehydrated okra, or dried okra, is used in a variety of recipes. It is a popular method of preserving okra that increases its stability in storage and makes transportation easier. However, okra's nutritional qualities might be impacted by drying.

Problem Statement

Fresh okra has a high moisture content, which makes it prone to rapid spoiling, quality degradation, nutrient loss, and decreased storage stability despite its nutritional advantages. Effective preservation methods are therefore essential to extending the shelf life of okra while maintaining its nutritional content and flavour characteristics.

Significant of the Study

The research focuses on figuring out the best drying methods for okra to retain its nutritional value, taste, texture, and other beneficial properties. The research will help create culinary techniques that highlight the healthful qualities of okra, guide food manufacturers in developing products that strike a balance between nutritional value and sensory appeal, and inform dietary recommendations for consumers looking for increased nutritional benefits.

MATERIALS AND METHODS

Sample Preparation

A Nigerian okra farm in Ikole Ekiti provided the fresh okra material. Analytical-grade chemicals and reagents were acquired from the Food Science and Technology Department of Federal University Oye-Ekiti.

Dried Okra Slices Preparation

The dried okra slices were prepared in dryers according to the methods described by Hussein et al. (2018). The drying experiment was carried out between April and May, 2024. After being cleaned with fresh water, the okra samples were pre-treated for 30 seconds in boiling water and then drained. After that, the sample were separated into three sections, each of which was manually cut with a vernier calliper to a thickness of around 4 mm. One kilogramme of sliced okra was initially placed in a single layer within a wire mesh tray and dried in a dehydrator set to 50 and 60 degrees Celsius. One kilogramme of the second piece was dried at 50 and 60 degrees Celsius in a hot-air oven (Model: TO 008GA-34, Akal-Tokiyo, Japan). Hussein et al. (2017) used a hybrid photovoltaic sun drier with a solar collector as only heating source to dry the remaining 1 kg at 50°C and 60°C for roughly 10 hours every day. The moisture content was determined according to the methos of Association of Official Analytical Chemists (2004).

Proximate Analysis of the Dried Okra Slices

The Association of Official Analytical Chemists (2010) standard method was used to determine the dried okra slices' proximate composition, which included protein, fat, crude fibre, moisture, and ash content. The carbohydrate content was determined by using another method.

Dried Okra Slices Functional Properties

Emulsion stability and capacity were determined according to the methods of Onwuka (2005). Okra samples swelling capacity was assessed using the techniques outlined by Adepeju et al. (2014).

Sensory Analysis of Okra Slices

After screening for familiarity with the okra samples, thirty (30) untrained panellists who were students at Federal University, Oye Ekiti, assessed the sensory profile of the dried okra slice samples. A 9-point hedonic scale was used to assesed taste, color, flavour/aroma, texture, appearance, and general acceptability of slices okra according to method of Iwe (2010).

Statistical Analysis

A one way ANOVA was used to statistically analyze the acquired data. The Duncan Multiple Range test (SPSS version 23 computer software) was performed to differentiate the means at a 95% confidence level.

RESULTS AND DISCUSSION

Nutrient Composion of Dried Okra Slice

Figure 1 displays the findings of the dried okra slices' proximate composition. Okra that was sun-dried had the highest moisture content (11.27%), whereas okra that was oven-dried at 60°C had the lowest (8.08%). The moisture content of wheat and starch dried foods is around 10% (Ogunlakin et al., 2012). The protein content varied substantially ($p < 0.05$) between samples, with solar-dried okra slices having the lowest value (14.78%) and dehydrated (18.91 %) and oven-dried slices (18.91 %) at 50°C. Okra dried in a dehydrator at 50°C had a considerably ($p<0.05$) greater fat level (2.67%) than okra dried at other temperatures and methods, while oven-dried okra slices at 60°C and solar-dried okra slices had the lowest fat content (2.10% and 2.09%, respectively). There were no significant differences in the fibre content across the various approaches. The okra that was dehydrated at 50°C had the highest ash percentage (8.67%), whereas the sample that was sun-dried had the lowest. The carbohydrates content was significantly higher in oven dried and solar dried okra slices with a value of 56.02% and 55.35% compared to the other methods.

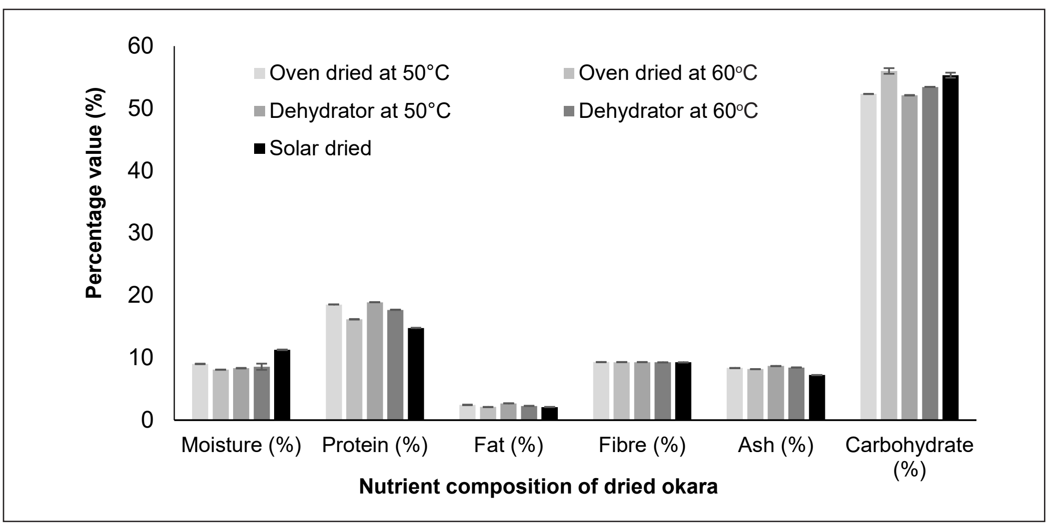

Figure 1. Nutrient content of dried okra slices

Dried Okra Slices Functional Properties

Table 1 shows the functional property results for the dried okra. When compared to other drying techniques, the highest emulsion capacity (48.39 %) and swelling capacity (41.38 %) were recorded in dehydrated okra (50°C), demonstrating superior functional qualities. Okra slices dried in a dehydrator at 50°C (37.15%) and oven-dried at 50°C (38.66%) had the maximum emulsion stability. Particularly in terms of emulsion stability (34.92%) and swelling capacity (38.90%), solar drying did not perform well. Functional property values were consistently lower after oven drying at 60°C.

Table 1
The effects of drying methods on functional property of okra slices

Sample	Emulsion capacity (%)	Emulsion stability (%)	Swelling capacity (%)
Oven dried at 50°C	46.45±0.23[b]	38.66±0.51[a]	39.76±0.30[ab]
Oven dried at 60°C	45.00±0.41[b]	34.55±0.09[c]	38.52±0.20[b]
Dehydrated at 50°C	48.39±0.032[a]	37.15±0.24[b]	41.38±0.37[a]
Dehydrated at 60°C	45.97±0.08[b]	35.26±0.19[c]	39.31±0.43[ab]
Solar dried	45.49±0.011[a]	34.92±0.10[c]	38.90±0.26[b]

Note. Values in each column with same letters are not significantly different at 5% level of significant

Dried Okra Slices Sensory Attributes

In sensory evaluations, okra slices dried by an oven or dehydrator generally received significant ($p<0.05$) preferences higher scores for attributes like colour, texture, and flavour, while solar-dried okra is rated significantly lower across all parameters (Table 2). The differences in sensory quality can be attributed to the drying conditions, such as temperature, air circulation, and drying time, which affect the degradation of pigments and volatile compounds

Table 2
Sensory attributes of okra as affected by drying methods

Sample	Appearance	Brittleness	Texture	Aroma	Overall Acceptability
Oven dried at 50°C	8.10±0.22[a]	7.58±0.65[a]	7.36±0.62[a]	8.21±0.25[a]	8.47±0.21[a]
Oven dried at 60°C	8.45±0.14[a]	7.70±0.44[a]	7.49±0.42[a]	8.47±0.12[a]	8.43±0.20[a]
Dehydrated at 50°C	8.41±0.25[a]	7.45±0.14[a]	7.27±0.11[a]	8.38±0.27[a]	8.15±0.29[a]
Dehydrated at 60°C	7.97±0.42[a]	7.68±0.36[a]	7.45±0.32[a]	7.99±0.46[a]	8.08±0.53[a]
Solar dried	6.23±0.70[b]	6.11±0.24[b]	6.12±0.21[b]	6.22±0.72[b]	6.013±0.22[b]

Values in each column with same letters are not significantly different at 5% level of significant

CONCLUSION

It can be concluded that the nutrient composition of different dried okra slices varied significantly ($p<0.05$). However, there were no appreciable differences in the fibre content between the various approaches. The best way to maintain dried okra's useful qualities was to dry it in a dehydrator set to 50°C. This critical review emphasizes how crucial it is to choose the right drying techniques in order to optimize the nutritional value and practical uses of dried okra in food products. Okra that had been oven-dried or dehydrated was significantly ($p<0.05$) preferred above samples that had been sun-dried. The biochemical characteristics of the dried okra slices should be investigated.

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