Effects Of Storage Life and Variety on The Functional Properties Of Stored Achicha

David-Chukwu N. P.; Onwuka, G. I.; Onuabuchi, I. C.; Amadi, A. G.; Chukwu, M. N.; Odom, T. C.; Onumadu, K. S.

1Department of Hospitality Management and Tourism, Abia State Polytechnic, Aba, Nigeria
2Department of Food Science and Technology, Michael Okpara University of Agriculture, Umudike, Nigeria.
3Department of Food Technology, Abia State Polytechnic, Aba, Nigeria.

*Corresponding Author: Chukwu, M. N.,* 1Department of Food Technology, Abia State Polytechnic, Aba, Nigeria.

Received date: Jan 01, 2024: Accepted date: Feb 16, 2024: Published date: Feb 19, 2024

Citation: Chukwu, M. N.*, (2024), Effects of Storage Life and Variety On The Functional Properties Of Stored Achicha. Dietary Nourishment and Food Processing Techniques (DNFPT)1(1), DOI: 10.1875/dnfpt.2024/004.

Copyright: © 2024, Chukwu, M. N.*, this is an open-access article distributed under the terms of The Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Abstract:
The effects of storage life and variety on the functional properties of stored achicha were determined. A-5 kg corms were sorted, washed and boiled for 3 hours and was cooled, peeled and cut into small sizes of average of 2.0 cm by 1.5 cm dimension with a sharp kitchen knife; dried under the sun for 5 days. The dried corms (achicha) were pulverized with a locally fabricated machine and stored in plastic containers for 0, 1, 2, 3-month(s) intervals. The data obtained were analyzed statistically using SPSS version 23. Means were separated at $P \leq 0.05$ using Fisher’s Least Significant Differences. After 3 months storage, edeofe, cocoindia and anampu had the following functional properties of achicha: bulk density (0.85, 0.70, 0.60)g/ml, swelling index (0.82, 1.09, 0.92), water absorption capacity (2.08, 2.15, 2.13), oil absorption capacity (0.65, 0.85, 0.86), wettability (16.80, 13.81, 15.72), gelation capacity (0.78, 0.70, 0.39)g/5ml, gelation temperature (84, 80, 83)°C, foam stability (5.08, 6.90, 5.00)%, foam capacity (11.29, 12.78, 9.10)%, viscosity (0.11, 0.18, 0.16)mPa and pH (5.59, 6.35, 6.03) respectively. The functional properties showed that they have better potential as soup thickeners. This showed that cocoindia had more stable functional properties than other varieties after 3 months storage.

Key Words: Storage, pH, thickener, absorption, capacity, density

Introduction
Achicha (dried cocoyam corms/cormels) is a pre-cooked, sun-dried cocoyam corms/cormels and it lends its name to the vegetarian dish made with it. Achicha does not only have enjoyable taste and satisfying but also low in calories. Achicha can be cooked in combination with fiofio (pigeon pea) or black beans (akidi oji), these are highly nutritional. Green leafy vegetables can also be added to it, for example, green amaranth, ugu and scent leaf. Dry fish is also added which is an optional ingredient (David-Chukwu et al., 2021a, b; 2022).

Cocoyam (Colocassia and Xanthosoma spp.) is a stem tuber that is widely grown in the tropical regions of the world (Eze and Okorji, 2003). About 60% of the World’s cocoyam production (5.7 million tons) is in Africa and majority of the remaining 40% in Asia and the Pacific (Mitra et al., 2007). Eze and Okorji (2003) also reported that Nigeria is the largest producer of cocoyam in the world, accounting for about 40% of the total world output. According to Manner and Taylor (2010), in other parts of the world, species of Colocasia are often referred to as taro, while cocoyam or tannia is used for species of Xanthosoma. In the Pacific Island countries where taro is widely cultivated and consumed, two botanical varieties of Colocasia have been identified as C. esculenta var. esculenta, many times called dasheen, and C. esculanta Var. esculenta, frequently called eddoe. It is referred to as the third important staple root crop after yam and cassava in Nigeria and provides a cheaper yam replacement, especially during periods of food scarcity or insufficient food supply (Onyeka, 2014).

The traditional way to cook taro is roasting on stones or baking in a ground oven. More modern ways of processing taro include steaming, boiling, or baking in the oven (Soudy et al., 2010). It must be thoroughly cooked to prevent mouth and throat itching. The corms and leaves of taro are usually eaten by humans after heat treatments, such as boiling, blanching, steaming, baking, roasting, stewing, and frying and pressure cooking. These methods are effective in improving its digestibility, increasing nutrient bioavailability, minimizing anti-nutritional factors and food-borne diseases. When taro corms are processed into powder and further decrease will occur when processed into taro noodles and cookies (Soudy, et al., 2010). Therefore, the combination of cooking time temperature program is necessary to preserve the nutrients and deactivates the anti-nutritional factors. Cooking substantially may be used in the management of non-communicable illnesses such as...
obesity, heart disease, blood pressure, diabetes, cancer and gastrointestinal disorders because of the high fibre content (Soudy et al., 2010).

Following the proper drying process, a number of tuber products are harvested and preserved as flour. In the feed and food industries, plays a critical role. According to certain recent studies, making flour from the roots of Colocasia esculenta is a straightforward process. This method involves cooking taro roots in their skin, peeling them, letting them dry in the sun, and then pulverizing them through 500 µm sieves (Njintang and Mbofung, 2003). Taro flour that has been processed can be used to make bread, baby food, cookies, pasta, and other foods. According to Alam and Hasinain (2009), this process disrupts the starch granules in flour, which causes it to become pre-gelatinized and absorb water. This alteration has a significant impact on the flour's functional qualities. Consequently, when mixed with water, it can produce binder properties that instantly produce a homogeneous matrix. Additionally, pre-gelatinized products are said to have a higher overall acceptance rate (Chinnajarn et al., 2006).

2.0 Materials and Methods

2.1 Materials

The National Root Crop Research Institute in Umudike, Abia State, provided the fresh cocoyam corms/cormels (ede ofe, NCE 002), cocoindia, NCE 001, and ukpong/anampu, NCE 004). The agronomist from the Cocoyam Unit of the National Research Institute Umudike, Abia State, identified the fresh samples. Figures 1 and 2 depict the cocoyam corms/cormels.

2.2 Methods

2.2.1 Processing of Corms/cormels into Achicha (dried cocoyam)

For every sample, five kilograms of cocoyam corms or cormels were sorted, cleaned, and cooked for three hours. With a sharp kitchen knife, it was cooled, peeled, and cut into small pieces, measuring an average of 2.0 cm by 1.5 cm. For five days, from nine in the morning to six in the evening, they were laid out on a mat and allowed to dry in the sun. A locally built machine was used to grind the dried cocoyam corms/cormels (achicha) before they were placed in different plastic containers for duration of three months. The samples were examined at zero, one, two, and three month intervals. Figures 1, 2, 3, and 4 display images of the cocoyam plant, corms/cormels, and processed achicha, respectively. Additionally, Figure 3 depicts the flow chart for producing achicha from cocoyam corms/cormels (David-Chukwu et al., 2021a, b; 2022).

2.2.2 Determination of Functional Properties of Achicha

The functional properties of the achicha flour samples were measured, and these included bulk density, swelling index, wettability, gelation capacity, gelation temperature, foam stability, foam capacity, viscosity, and pH.

2.2.2.1 Determination of Bulk Density

Using the technique outlined by Chukwu et al. (2018) and Peter-Ikechukwu et al. (2020), the bulk density of the flour samples was calculated. The sample was put into an A-10 ml graduated cylinder. On a lab bench, the bottom of the cylinder was repeatedly tapped gently. Once the 10 ml mark was filled, the procedure was repeated until the sample level did not decrease any further. The weight of the samples divided by the sample volume (g/ml) was used to compute bulk density.

{\[
\text{Bulk density (g/ml)} = \frac{\text{Weight of Sample (g)}}{\text{Volume of Sample (ml)}},
\]}

2.2.2.2 Determination of Swelling Index

Using the technique outlined by Mbanali et al. (2018), the swelling index was calculated. It was calculated as the proportion of the swollen volume of extra water. A 1 g sample of flour was mixed with 10 ml of distilled water in a calibrated 10-milliliter measuring cylinder, and the volume was recorded. For one hour, the cylinder was allowed to remain undisturbed. After recording the volume that the sample subsequently occupied, the swelling capacity was computed as follows:

{\[
\text{Swelling Index} = \frac{\text{Volume occupied by sample after swelling}}{\text{Volume occupied by sample before swelling}}.
\]}

Fig 1: Plant Colocasia esculenta

Fig 2: Corms/cormels of Colocasia esculenta
Cocoyam corms/corm

Sorting
washing
Cooking (3hr)
Cooling
Peeling
Cutting
Sun-drying (5days)

Fig3: The production flow chart for achicha

2.2.2.3 Determination of water and oil absorption capacity

According to Peter-Ikechukwu et al. (2020), the water and oil absorption capacity was determined. Ten milliliters of distilled water or oil were added to a graduated centrifuge tube containing a weighed sample weighing one gram. After that, the sample was well combined and left to stand at room temperature for half an hour. For thirty minutes, the mixture was centrifuged at 4000 rpm. For the purpose of converting the volume of free water or oil (the supernatant) to grams, its density was multiplied. The result was expressed as grams of water or oil absorbed per gram of sample. It was assumed that oil had a density of 0.88 g/ml and water had a density of 1 g/ml

\[
\text{WAC/OAC} = \frac{V_1 - V_2}{W} D
\]

Where:
- WAC=Water absorption capacity
- OAC=Oil absorption capacity
- \(V_1\)=Initial volume of water or oil
- \(V_2\)=Final volume after centrifuging
- W= Weight of sample.
- D= Density of water/oil

2.2.2.4 Determination of Wettability

One gram of the sample was weighed into a 25 ml graduated cylinder with a 1 cm diameter, slightly modified from Chukwu et al. (2018). The cylinder was inverted, clamped at a height of 10 cm from the surfaces of a 600 ml breaker containing 500 ml of distilled water, and the open end was covered with aluminum foil paper. The aluminum foil paper was then removed to allow the test material to be damped. The amount of time needed for the sample to get completely wet was its wettability.

2.2.2.5 Determination of Gelation capacity

The gelation capacity was calculated using an Onwuka (2018) modified method. In test tubes, 2–20% (w/v) flour suspensions were made using 5 milliliters of distilled water. The suspensions were quickly cooled under cold running tap water after being brought to a boil in a water bath for an hour. The least gelling concentration, also known as the gelation capacity, was defined as the lowest concentration at which the gel formed did not collapse or slips from the invented test tube.

2.2.2.6 Determination of Gelation Temperature

The gelation temperature was calculated utilizing the Onwuka (2018) method. In a test tube, a 10% w/v sample was made. Thirty seconds after gelatinization was visibly observed, the temperature of the aqueous suspension was measured while it was heated in a boiling water bath while being continuously stirred.

2.2.2.7 Determination of Foam stability

Foam stability was assessed by applying the Onwuka (2018) method. In a blender, 2 grams of each sample's measured weight was whipped for 5 minutes at 1600 rpm using 100 milliliters of distilled water. The whipped mixture was poured into a graduated cylinder measuring 150 milliliters. After gently adding 10 milliliters of distilled water to the graduated cylinder, the blender jar was cleaned. The cylinder's foam volume varies every 15, 30, 60, 90, and 120 seconds.

\[
\text{Foam stability} = \frac{\text{Foam Volume after time} \times 100}{\text{Initial Foam Volume}}
\]

2.2.2.8 Determination of Foam Capacity

The Chukwu et al. (2018) method was utilized to ascertain the foam capacity. Each sample was weighed out at 2 g, and it was blended for 5 minutes at 1600 rpm using 100 ml of distilled water in a blender. A 150 ml graduated cylinder was filled with the whisked mixture. After being cleaned with 10 milliliters of distilled water, the
blender jar was carefully placed into the graduated cylinder, and after 30 seconds, the volume was recorded. Volumes recorded both before and after whipping were computed as follows:

\[
\text{Foam capacity} = \frac{\text{Volume after whipping} - \text{Volume before whipping}}{100} \times \text{Volume before whipping}
\]

### 2.2.2.9 Determination of Viscosity

According to Peter-Ikechukwu et al. (2019), a sample weighing 10 g was dissolved in 100 ml of distilled water and kept at room temperature for two hours while being mechanically stirred. We used a viscometer (model ND-J9S) to measure the viscosity.

### 2.2.2.10 Determination of pH

Chukwu et al. (2018) and Peter-Ikechukwu et al. (2020) provided the method used to determine the pH. In distilled water, a sample (10% w/v) was prepared. The sample was well combined, and a pH metre (model PHS-3C, China) was used to measure the pH.

### 2.2.3 Statistical analysis

Version 23 of SPSS software was used to statistically analyze the obtained triplicate data. After determining the mean values, One-Way ANOVA was performed, and Fisher's Least Significant Difference (Landau and Everitt, 2004) was applied to separate the means (P ≤ 0.05).

### 3.0 Results and Discussion

#### 3.1 Functional Properties of Achicha During Three Months of Storage

The comparison of the mean functional properties of three distinct Colocasia varieties (edoe, cocoindia, and anampu) of processed achicha over a three-month storage period is presented in Table 1.

<table>
<thead>
<tr>
<th>Functionality Property</th>
<th>Edofe (Month)</th>
<th>Cocoindia (Month)</th>
<th>Anampu (Month)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

References


