Food Science and Quality Management www.iiste.org
ISSN 2224-6088 (Paper) ISSN 2225-0557 (Online)
Vol.37, 2015

# Quality Attributes of Heat Treated Cocoyam (Colocasia esculenta) Flour

Ogundare-Akanmu O.A.[1*] Akande S.A[2] Inana M.E[2], Israel D[2]. Adindu M.N[2]
1.Nigerian Stored Products Research Institute P. M. B 5044 Dugbe, Ibadan, Oyo State. Nigeria
2.Nigerian Stored Products Research Institute P. M. B. 5063 Port Harcourt, Rivers State. Nigeria
*E-mail of the corresponding author: olubukolaogundare@gmail.com

**Abstract**
Cocoyam (Colocasia esculenta), a staple food and a food thickner has a small starch grains and improved digestibility. In view of adding value to cocoyam, this study investigated the effect of different processing methods on the quality of cocoyam flour. In this study, cocoyam samples were given different heat treatments and milled into flour. The moisture content of the flour samples ranged between 7.85% - 18.75%. Protein content was between 3.48% - 12.60%. Loose bulk density ranged between 0.77g/cm$^3$ – 0.83g/cm$^3$ initially and 0.45g/cm$^3$ – 0.56g/cm$^3$ finally. Starch content ranged from 16.06% - 52.84%. The control sample that has no heat treatment has the highest value of overall acceptability.
**Keywords :** Cocoyam, digestibility, heat treatment and value addition

## 1.Introduction

*Colocasia esculenta* and *Xanthosoma sagittifolium* (Cocoyam) are herbaceous perennial plants belonging to the *Araceae* family and constitute one of the six most important roots and tuber roots worldwide (Jennings, 1987). It is an under-exploited tuber crop although the literature is replete with its potential nutritional applications (Amandikwa, 2012). Annual production of cocoyam in Nigeria is estimated at 26.587 million tonnes. Nigeria is the world's largest producer of cocoyam, accounting for about 375 of total world output (FAO, 2006). Like many plants of the Araceae family, cocoyam grows from the fleshy corm (tuber) that can be boiled, baked, mashed into a meal and used as staple food or snack. In the eastern part of Nigeria, it serves as a staple food and is used as a thickener in food preparations. This is because the starch grains of cocoyam (corms) is small and has improved digestibility as this is an important factor when selecting a starchy food that will not be cumbersome on the digestive system (Amandikwa, 2012; Ndabikunze et al, 2011). It contains substantial amounts of protein, vitamin C, thiamine, riboflavin, niacin, thiamine and significant amount of dietary fibre. Leaves of taro (Colocasia) are cooked and eaten as vegetable, and they contain β-carotene, iron and folic acid, which protect against anaemia. The main nutrient supplied by cocoyam as with other roots and tubers is dietary energy provided by the carbohydrates (Jirarat and Pasawadee, 2006).

Cocoyam like other root crops deteriorates few weeks after harvest due to inadequate post harvest technologies and this make the crop scarce and expensive outside the harvesting period. Processing of cocoyam into flour will automatically extend the shelf life of the commodity, thereby making it available for use all year round. Cocoyam flour can be used in the preparation of soups, biscuits, bread, beverages and puddings. However, in spite of its importance as a staple food in many countries, cocoyam has received very little research attention to enhance its production and utilization potentials. Despite their nutritional composition, the potential for the development of value added cocoyam products have not been so much investigated (Palapala et al, 2005). Opportunities to promote and support the use of cocoyam can make a major contribution to the food security of countries in the cocoyam growing regions. It is for this reason that the study investigated the effect of different processing methods on the quality of the flour.

## 2. Materials And Methods

2.1 Material Collection

A variety of cocoyam (*Colocasia esculenta*) was procured from farmers in Port Harcourt market, Nigeria, cleaned to remove the soil, dried petiole and washed in portable water. It was drained and portioned into four to obtain four different treatments.

Production of Cocoyam Flour Samples

Treatment 1: A portion of unpeeled cocoyam was boiled in water for 15minutes
Treatment 2: A portion of unpeeled cocoyam was blanched in boiling water for 15minutes.
Treatment 3: A portion of unpeeled cocoyam was steamed in boiling water for 15minutes.
Treatment 4: A portion of unpeeled cocoyam was not given any moist heat treatment.

All the treated and control samples were peeled, cut into thin slices and dried in the oven at 85$^o$C until they were crisp and fragile. Each of the dried samples were milled separately using a hammer mill and sieved using a 500µm sieve to obtain the flour. The flour obtained were packed in sealed polythene for further analysis and stored for four months.

2.2 Physicochemical Analysis

The physicochemical composition was determined using the method of A.O.A.C. (2000).

Protein content was determined on 0.5g sample by the kjeldahl method. The percentage nitrogen obtained was used to calculate the crude protein by multiplying with a conversion factor of 6.25. Moisture content was determined on 5g sample using the gravimetric method at 105$^{o}$C for 4hours. Ash content of the samples was determined on 2g sample by incinerating in a muffle furnace at 600$^{o}$C for 2hours. The ash was cooled in a desiccator and weighed. Fat content was determined on 5g sample using the soxhlet solvent extraction method. The carbohydrate content was calculated by difference. Bulk density was determined by Narayara and Narasinga (1989). Loose bulk density was determined by placing 20g of the sample into a measuring cylinder of a known volume and the volume was recorded without tapping. Sensory tests were done using A.O.A.C. (2000) methods. They were done using 15 panellists who are familiar with the product. The flours were assessed on a 7-point hedonic scale where 1 represented 'dislike extremely' and 7 represented 'like extremely'. All the analysis were carried out monthly and stored for four months.

**3. Result And Discussion**

Table 1 shows the result of the proximate composition of the cocoyam flour samples. T.he moisture content of the flour samples ranged from 7.85% - 18.75% during the four months storage period. The moisture content fluctuated during the storage period with the steamed sample having the least initial value. This might be due to changes in temperature and relative humidity (21$^{o}$C -29$^{o}$C and 80% - 93%). Protein content of all the samples (3.48% - 12.60%) increased during the storage period, except the control sample that decreased. It was also observed that protein content of three samples decreased after processing except the control samples, although wheat, cassava and cocoyam are poor sources of protein (Ogunlakin et al, 2012). The protein content of 3.48% to 12.6% reported for cocoyam in this work is slightly higher than 4.93% to 5.17% reported by Ogunlakin et al (2012). The observed variations in the result could be attributed to the differences of the species, cultural, climatic and other environmental factors under which the cocoyams were grown. Asaoka et al (1991) reported that age, variety, growth season and cultivar's type of tubers affect their physicochemical properties. Maturity at harvest, length of storage time and elapsed time between harvesting and processing period may also contribute to theses variations (Amandikwa, 2012). The variations in the protein values may also be connected with denaturation of cocoyam protein associated with the various heat treatments. Maillard reaction could also be responsible for losses of protein as this also depends on the intensity of heat and temperature. Fat content of the untreated sample (control) had the highest initial value (8%) and lowest final value (0.64%). Fat content of all samples decreased after the heat treatment and during storage period. The decrease in the fat content during the storage period could be associated with the oxidation of fat during the heating process, which can lower the chance of rancid flavour development. The starch content of all the samples increased at the end of the storage period. This may be due to the heat treatment which has a dried effect on the concentration of the food component. The loose bulk density ranged between 0.77g/cm$^3$ – 0.83g/cm$^3$ initially and 0.45g/cm$^3$ -0.56g/cm$^3$ finally, with the control sample having the highest value. For the sensory evaluation (subjectively), the control sample was the most acceptable, followed by steamed sample while the least acceptable sample was the boiled sample.

**Table 1** Effect of Different Processing Methods on Quality of Cocoyam Flour

| **Quality Parameters** | **Heat Treated Corms** | | | |
|---|---|---|---|---|
| | **Control** | **Boiled** | **Blanched** | **Steamed** |
| Moisture Content(%) | 17.4 | 18.75 | 18.65 | 9.95 |
| Protein Content(%) | 7.0 | 5.25 | 5.50 | 5.25 |
| Fat Content(%) | 8.00 | 5.35 | 6.50 | 7.00 |
| Starch Content(%) | 16.06 | 24.94 | 31.08 | 19.27 |
| Loose bulk Density(g/cm3) | 0.83 | 0.78 | 0.77 | 0.79 |
| Overall Acceptability | 6.0 | 2.00 | 4.00 | 5.00 |

**Table 2** Effect of Heat Treatment on Quality of Cocoyam Flour During Storage

| Heat Treatment | Parameters | Months | | | | |
|---|---|---|---|---|---|---|
| | | 0 | 1 | 2 | 3 | 4 |
| Control | Moisture Content(%) | 17.40 | 7.85 | 9.55 | 9.95 | 10.90 |
| | Protein(%) | 7.00 | 4.86 | 4.50 | 3.49 | 5.28 |
| | Fat(%) | 8.00 | 2.46 | 1.58 | 0.66 | 0.64 |
| | Starch(%) | 16.06 | 38.91 | 43.73 | 39.90 | 38.95 |
| | Loose Bulk Density(g/ml) | 0.83 | 0.64 | 0.56 | 0.50 | 0.46 |
| | Overall Acceptability | 6.00 | 6.00 | 6.00 | 6.00 | 5.00 |
| Blanched | Moisture Content(%) | 18.65 | 10.80 | 11.10 | 10.75 | 11.30 |
| | Protein(%) | 5.50 | 9.73 | 10.38 | 11.55 | 11.73 |
| | Fat(%) | 6.50 | 1.87 | 1.23 | 0.98 | 0.82 |
| | Starch(%) | 34.08 | 34.68 | 34.91 | 41.21 | 40.51 |
| | Loose Bulk Density(g/ml) | 0.77 | 0.61 | 0.63 | 0.58 | 0.54 |
| | Overall Acceptability | 4.00 | 4.00 | 4.00 | 4.00 | 3.00 |
| Boiled | Moisture Content(%) | 18.75 | 11.55 | 12.30 | 11.80 | 11.75 |
| | Protein(%) | 5.25 | 6.91 | 8.93 | 9.80 | 12.60 |
| | Fat(%) | 5.35 | 1.97 | 1.65 | 1.20 | 0.96 |
| | Starch(%) | 24.94 | 38.35 | 41.62 | 37.80 | 36.67 |
| | Loose Bulk Density(g/ml) | 0.78 | 0.62 | 0.68 | 0.61 | 0.56 |
| | Overall Acceptability | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 |
| Steamed | Moisture Content(%) | 9.95 | 11.30 | 11.60 | 11.20 | 11.75 |
| | Protein(%) | 5.25 | 8.12 | 9.76 | 10.50 | 11.55 |
| | Fat(%) | 7.00 | 3.08 | 2.71 | 1.86 | 1.20 |
| | Starch(%) | 19.27 | 49.72 | 52.84 | 44.78 | 43.25 |
| | Loose Bulk Density(g/ml) | 0.79 | 0.69 | 0.63 | 0.58 | 0.51 |
| | Overall Acceptability | 5.00 | 5.00 | 3.00 | 5.00 | 4.00 |

## 4. Conclusion

Flour from the control sample that was not subjected to any heat treatment retained more nutrients. The danger with the control sample is that it may contain relatively more irritant since it was not given similar heat treatment like the other heat-treated samples. If the untreated flour sample (control) is to be used, it must be under condition that will require additional heat treatment to reduce irritant. The study also revealed that steam treatment has potential to yield cocoyam flour of acceptable colour and quality.

## References


Amandikwa Chinyere (2012). Proximate and Functional Properties Of Open Air, Solar And Oven dried Cocoyam Flour. International Journal of Agric and Rural Development 15(2):988 -994.

A.O.A.C (2000). Official Methods of Analysis. Association of Analytical Chemists, Washington D.C. 15th Edition.

Asaoka M, Blanchard J.M.V and Richard J.E (1991). Seasonal Effects on The Physicochemical Properties of Starch From Four Cultivars of Cassava. Starch/Staerke 43:455-459.

FAO Statistics (2006). Food And Agricultural Organization Database Results. www.fao.org.

Jennings D.L (1987). Starch Crops In: CRC Handbook of Plant Science in Agriculture (Edited by Christie B. R.) CRC Press Inc. Boca Raton, Florida USA. 2:1377 – 1430.

Jirarat T, Sukruedee A and Pasawadee P (2006). Chemical and Physical Properties of Flour Extracted From Taro *Colocasia esculenta* (L) Schott Grown In Different Regions of Thailand. Sci. Asia 32:279 -284.

Narayara K and Narasinga R.M.S (1989). Effect of Partial Hydrolysis on Winged Bean (Psophococarus tetregono lobus) Flour. Journal of Food Science 49:944-947.

Ndabikunze B.K, Talwana H.A. L, Mongi R.J, Issa-Zacharia A, Serem A.K, Palapala V. And Nandi J.O.M (2011). Proximate And Mineral Composition of Cocoyam (*Colocasia esculenta* L. And *Xanthosoma sagittifolium* L.) Grown Along the Lake Victoria Basin In Tanzania and Uganda. African Journal of Food Science 5(4):248-254.

Ogunlakin G.O, Oke M.O, Babarinde G.O and Olatunbosun D.G (2012). Effect of Drying Methods On Proximate Composition and Physicochemical Properties of Cocoyam Flour. American Journal of Food Technology 7:245 -250.

Palapala V, Talwana H, Nandi J.O.M, Sereme A.K and Ndabikunze B.K (2005). Evaluation of Prospects and Constraints To Sustainable Cocoyam (Colocasia esculenta) Production In Lake Victoria Crescent. A project Report.