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DRYING METHODS AND THEIR EFFECTS ON PROXIMATE COMPOSITION AND GELATION PROPERTIES OF COCOYAM (*Colocasia esculenta*)

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A comparison of two drying methods (sun and oven-drying) was conducted to determine the effects on various quality attributes of flour samples made from cocoyam, *Colocasia esculenta* (Taro). The nutritional value and characteristic properties of the cocoyam flour were investigated using the proximate and least gelation concentration. The results of the laboratory analysis disclosed that the moisture content (7.98%), ash content (4.92%), crude fat (4.20%), protein (9.30%) and least gelation concentration (8.40%) of the sun-dried cocoyam flour samples values were the higher than the samples dried in the oven except for crude fiber (9.42%) and carbohydrate (67.36%).The study revealed that drying techniques considerable have effect on proximate and least gelation concentrations of cocoyam flour.
Keywords: Drying Methods, Taro cocoyam, Proximate and Least Gelation Concentrations

Introduction

In southeast Nigeria, Taro cocoyams (*Colocasia esculenta*) are an important staple food crop. According to Bolarin *et al*. (2018), the cocoyam belongs to the Araceae family of monocot plants and is one of the six most important root and tuber crops in the world. They are still an important staple in some areas of the jungles and sub-jungles, although being less important than other tropical root harvests like sweet potatoes, cassava and yam (Igbeka, 2013). Nigeria is the world's largest producer of cocoyam, accounting for over 37% of global production which translates to 26.587 million tons of cocoyam yearly (Hayata *et al*., 2006 and FAO, 2006). According to Hayata *et al*. (2006) and Lewu *et al*. (2009), cocoyam is rich in stomach-related starch, excellent quality protein, L ascorbic acid, thiamine, riboflavin, niacin, and high protein and essential amino acid scores. The cocoyam which mostly serves as a thickener in meals still have great potentials for food security, income generation and nutritional enhancement in the households though grossly underutilized. Hence, facilitate the need for this study to ascertain the effects of drying methods on proximate composition and least gelation concentration of cocoyam flour.

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Materials and Methods

Taro cocoyam (*Colocasia esculenta*) cultivar was harvested early February, 2023 at physiological maturity stage of seven months and two weeks of planting, the Taro cocoyam samples were sourced from Enugu State Agricultural Development Programme Office in Enugu State, Nigeria. The obtained samples were immediately transported and stored in temperature and relative humidity rate of 28°C ± 3 °C and 82 ± 5% respectively.

The cocoyam samples of cultivar (1 kg) were sorted, washed with potable water to remove adhering soil, and peeled manually with stainless steel knife. The peeled root crops were washed with portable water and sliced into 10 mm thickness and soaked into 0.02% solution of sodium metabisulphite for 30 min to prevent oxidation browning. The sliced samples were divided into two equal batches with the first batch sun dried while the second batch were oven dried using Multipurpose oven (Model N0: MCQTR54) at 70^0C for 60 minutes internal until constant drying rates are attained. The dried cocoyam samples were then milled into flour using hammer mill, sieved through a standard laboratory sieve of 500-micron meter aperture to produce uniform particle size flour, packaged in polythene bags, sealed and then stored in air tight containers with appropriate label (A & B) and then carried to the laboratory where the samples were investigated. The sample preparation stages are shown in figure 1.

Figure 1 : Pictorial description of processing stages of cocoyam flour

Proximate composition determination: Moisture content of cocoyam flour was determined gravimetrically; ash, crude fibre, crude fat and protein contents of cocoyam flour were determined using official methods AOAC (1990). Carbohydrate content was also determined by difference described by AOAC (1990). The Least Gelation Concentration (LGC) of the sample was determined using the method of Coffmann and Garciaj (1977).

Results and Discussion

The results obtained from determination of the effect of drying methods on the proximate composition and least gelation concentration of cocoyam flour is presented in Table 1

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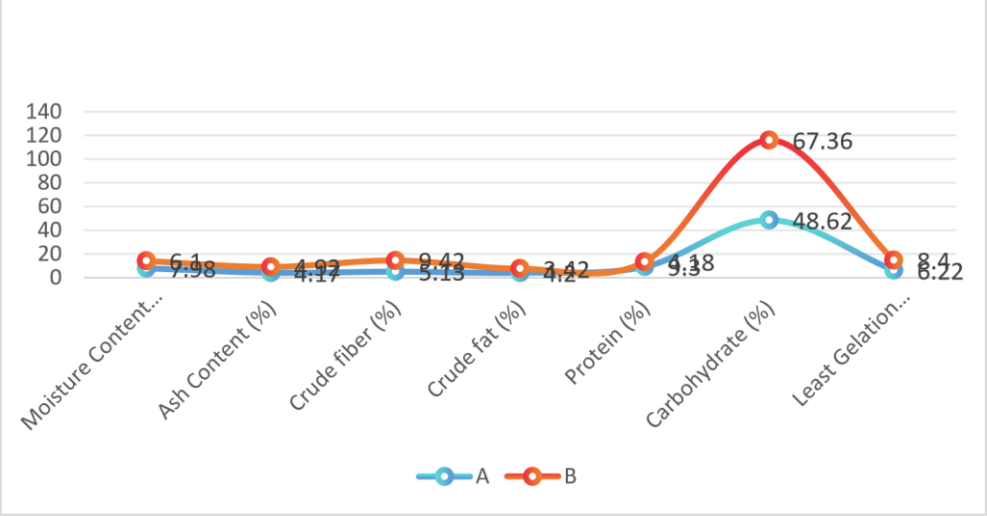
Table 1. Proximate composition and least gelation concentration of cocoyam flour Taro variety

Parameters	**A**	**B**
Moisture Content (%)	7.98	6.10
Ash Content (%)	4.17	4.92
Crude fiber (%)	5.13	9.42
Crude fat (%)	4.20	3.42
Protein (%)	9.30	4.18
Carbohydrate (%)	48.62	67.36
Least Gelation Concentration (%)	6.22	8.40

A=Taro sun-dried, B= Taro oven-dried



The graphical representation of proximate composition and least gelation concentration of cocoyam flour Taro variety

Proximate composition: The results of moisture, ash content, crude fiber, crude fat, protein and carbohydrate of cocoyam flours that were produced using sun and oven drying methods in their percentage composition are as shown in Table 1 and graphical representation above. The moisture content of the cocoyam flour samples indicated 7.98 and 6.10% with sun-dried cocoyam flour having the highest value and oven dried the lowest. This indicates that drying techniques has an effect on the moisture content of cocoyam flour produced. The lower value in oven dried samples maybe attributed to a great moisture loss by evaporation during drying. According to Emelike et *al*., (2015) and Akinhanmi and Atasie, (2008) Food with low moisture content could store for a longer time without spoilage.

The ash content which is the total mineral content, present in the samples revealed 4.17 and 4.92% with oven dried cocoyam flour having the highest value and sun dried sample having the lowest value. The result disclosed the presence of inorganic nutrients in the cocoyam flour samples, however temperature affects the ash content of the cocoyam flour produced in such a way that as the temperature increases, the ash content decreases; this was in accordance with the report of Blanco *et al.*(2004) which was on roots and tubers.

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The crude fiber of the processed cocoyam flour samples indicated 5.13 and 9.42 % with oven dried sample having the highest value and the sun dried sample revealing the lowest value. Crude fiber measures the cellulose, hemicelluloses and lignin content of food. Fibre has useful role in providing roughage that aids digestion (Marer and Martin 2003). Dietary fibre reduces the risk of cardiovascular diseases. Fibre consumption also soften stools and lowers plasma cholesterol level in the body (Norman and Joseph, 1995).

The Crude fat content revealed 4.20 and 3.42% with sun dried flour sample having the higher value; while the oven dried flour samples had the lower value. This indicates that temperature affected the fat content of cocoyam flour produced; this observation has been earlier reported by Enonfom and Umoh (2004) on cocoyam. Also, Makinde and Joel, (2019); Grundy *et al.,* (2015) attributed to the fact that oil bodies and the endoplasmic network of cocoyam are largely destroyed and volume of extracellular pores enlarged during sun drying.

The protein content observed stated 9.30 and 4.18% and it was found to be highest in the sundried cocoyam flour sample while oven dried sample had the lowest value. From the findings, it was observed that sun dry method improves the protein content of the samples, however in food processing as temperature increases, the protein content decreases; this is due to denaturation of the protein as reported by Sefa – Dedeh and Kofi-Agyir, (2002). Also maillard reaction could be responsible for losses of protein as this also depends on the intensity of heat and temperature.

The carbohydrate content revealed 48.62 and 67.36%, with the oven dried flour sample having the highest value while sun dried sample showcased the lowest value. From the findings, it was observed that temperature affected the percentage composition of carbohydrate samples in such a way that as drying temperature increases, the values of carbohydrate increases as well. This same temperature effect on carbohydrate was earlier reported by Amandikwa, (2012) on comparison of carbohydrate content of cocoyam dried in oven at 85^{o}C and solar dryer at 65^{o}C. Also, according to Enwere (1998), of all the solid nutrients in roots and tubers, carbohydrate predominates. Carbohydrate supplies quick source of metabolizable energy and assist in fat metabolism.

The Least Gelation Concentration (LGC) indicated 6.22 and 8.40% with oven-dried flour samples having the higher values while sun-dried sample had the lowest value. Variations in LGC may be attributed to the relative ratios of different constituent proteins, carbohydrate and fat in food samples (Sathe *et al*., 1982). The lower the least gelation concentration, the better it serves as a good binder or provider of consistency in food preparations such as semi solid beverages and the better the gelling ability of the flour (Adeyemi and Umar, 1994).

Conclusion

Various drying techniques can yield acceptable cocoyam flour, depending on the intended use. The proximate composition and least gelation concentration of the cocoyam flour samples are influenced by drying techniques, which change the biochemical content and functional qualities of the flour, according to the results of the experiment done on cocoyam flour. Sun-dried samples produced better results than oven-dried samples when it comes to the optimal technique for drying cocoyam corms that would retain their nutritional and functional values. In terms of food preparations, cocoyam can be a useful binder or source of consistency. Generally, this study revealed that drying techniques considerable have effect on proximate and least gelation concentrations of cocoyam flour.

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