Comparative Determination of Physicochemical Properties of Starch gotten from different varieties of Yam Consumed in Ozoro Town, Delta State, Nigeria.

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Abstract— Starchy roots and tuber crops are second only in importance to cereals as global sources of carbohydrates. They provide a substantial part of the world's food supply and are also an important source of animal feeds and processed products for human consumption and industrial uses. This study is aimed at the comparative determination of physico-chemical properties of starch gotten from different varieties of yam consumed in Ozoro town. The different varieties of yams used in this study were bought at the Ozoro main market and transported to the laboratory for analysis. The extraction of starch from the different varieties of yam and their physico-chemical properties were carried out using standard methods. Results obtained shows that the starch yield in the different yam varieties ranged from 23.1% -28.3%, moisture content: 5.15% -11.5%, ash content: 0.13% - 1.3%, bulk density: 0.58g/cm^3 – 0.82 g/cm^3 , amylose: 18.8% - 28.3%, swelling power: 8.2% - 11.1% and water binding capacity: 168.2% - 183.5%. These results shows that the different varieties of yam consumed in Ozoro town contains starch with good physicochemical properties (Moisture, Ash content, Bulk density, Amylose, Swelling power and water binding capacity). These yams can also serve as alternate sources of starch based on their unique characteristics and thus, can be used for diverse products.

Keywords: amylase, carbohydrate, extraction, moisture content, physic-chemical, starch yield, yam.

1 Introduction

Nutritional quality and mineral composition of primary agricultural and cultural foods in developing countries is a major health problem which has manifested as diet-associated disorders among the African population. Food and nutrition are known important modifiers of disease initiation and development. The major causes of illness and death appear to be the chronic degenerative diseases, such as cancer, heart disease, arthritis, respiratory diseases, diabetes, hypertension, cognitive impairment and various toxic states, which could be averted with proper nutrition and diet [1].

Starchy roots and tuber crops are second only in importance to cereals as global sources of carbohydrates. They provide a substantial part of the world's food supply and are also an important source of animal feed and processed products for human consumption and industrial use. Starchy roots and tubers are plants which store edible starch materials in subterranean stems, roots, rhizomes, corms, and tubers and are originated from diversified botanical sources. Potatoes and yams are tubers, whereas taro and cocoyams are derived from corms, underground stems, and swollen hypocotyls. Cassava and sweet potatoes are storage roots and canna and arrowroots are edible rhizomes. All these crops can be propagated by vegetative parts and these include tubers (potatoes and yams), stem cuttings (cassava), vine cuttings (sweet potatoes), and side shoots, stolons, or corm heads (taro and cocoyam) [2].

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Yams (*Dioscorea* spp.) are annual or perennial climbing plants with underground tubers that are suitable for eating. Yams are of great economic importance and nourishment to the people of Africa, the Caribbean, Asia and America [3]. There are some 600 species of yam, but only six are mostly grown as staple foods. These are *Dioscorea rotundata* (white yam), *D. alata* (water yam), *D. cayenensis* (yellow yam), *D. esculenta* (Chinese yam), *D. bulbifera* (aerial yam) and *D. dumetorum* (trifoliate yam) . Out of the six species commonly found in West Africa, *D. rotundata* is the most widely grown and generally considered to be the best in terms of food quality, thus commanding the highest market value [4].

Yam is grown and cultivated for its energy-rich tuber. White yam (*Dioscorea rotundata* Poir), is the most favoured yam species in West Africa because it possesses a highly viscous starch. Boiled yam, pounded yam and *amala* are yam products mostly consumed in West Africa [5]. Yam is an excellent source of starch, which provides caloric energy. Starch is an important functional food biopolymer that contributes to the quality of the final food product. Yam starch accounts for about 60-80% of the dry matter of yam tuber (on dry weight basis). Functionality of a food is the property of a food ingredient apart from its nutritional value that has great impact on its utilization. Sensory properties such as texture, appearance and taste are the main acceptability factors used by consumers to assess the quality of yam. These sensory factors are influenced by the physico-chemical and pasting properties of the starch [5].

Starch is the main component of yam and provides large proportion of daily caloric intake. The value of the yam as a basic food has been attributed to the high digestibility of its starch, which is present in the form of small granules. Since yam tubers contain about 70–82% starch, the cooking and processing characteristics of yams, the eating and storage quality of yam-containing products, and perhaps the physiological effectiveness of the bioactive ingredients involved will be greatly dependent on starch properties. Starch is an important raw material for a number of Industries including textiles, paper, adhesives, pharmaceuticals and food [4]. Little or no information on the physico-chemical and pasting properties

of the starches is one of the limiting factors for industrial application of non-official starches such as that from yams, hence this study is focused on the physico-chemical evaluation of starch produced from different varieties of yam consumed in Ozoro.

2 MATERIALS AND METHODS

The different varieties of yams used in this study were bought at the Ozoro main market and transported to the laboratory for analysis. The extraction of starch from the different varieties of yam and their physico-chemical properties were carried out using standard methods recommended by [6].

3 RESULTS AND DICUSSIONS

TABLE 1: RESULTS OF ANALYSIS

PARAMETERS	VARIETIES OF YAM			
	A	B	C	D
% starch yield	28.3	26.6	23.1	26.4
Moisture content (%)	6.32	7.45	11.51	5.15
Ash content (%)	0.63	1.3	0.13	0.83
Bulk density (g/cm^3)	0.82	0.76	0.72	0.58
Amylose (%)	28.3	26.9	18.8	24.2
Swelling power (%)	8.2	11.1	10.4	9.3
Water binding capacity (%)	168.2	171.5	183.2	175.4

3.1 DISCUSSION

From table 1 shown above, the starch yield in the different varieties of yams in this study ranged from 23.1%-28.3% with sample C (water yam starch) having the least starch yield of 23.1%. Moisture content is an important factor in food quality, preservation, and resistant to deterioration. Moisture content in the different varieties of yam starch ranged from 5.15%-11.51%. with sample D (cocoyam starch) having the least moisture content of 5.15% while sample C (water yam starch) have the highest moisture of 11.51%. Good quality starch should have moisture content in the range of 10-13.5% to ensure better shelf life [4]. The moisture levels were however below this range except for sample C (water yam starch) which have a moisture content of 11.51%. This may be as a result of a longer drying period of the starch after extraction. Hence, drying periods can be monitored and regulated to ensure that moisture content of these starches fall within the acceptable range. All starch samples in this study have low moisture content which indicates that they have a long shelf life.

Ash content of the different yam starch ranged in the order of 0.63% < 0.13 < 0.83 <1.3% for A, C, D and B samples respectively. Ash level may also be regarded as a measure of the quality or grade of the flour and often a useful criterion in identifying the authenticity of food as well as measures the mineral status of a sample [7]. Ash content of less than or equal to 0.20% is an indication of good quality starch [8]. The bulk density of the different starch ranged from 0.58g/cm^3 – 0.82 g/cm^3. The high bulk density of the flours suggests that they can be used as thickeners in food products and should not

be used in formulations where low bulk density is required such as in baby foods [5].

Amylose is one of the two major components of Starch. Amylose is a predominantly linear polysaccharide in which anhydroglucose units are linked by a-d-1,4 glucosidic bonds. Just a 0.3 to 0.5% of α-1,6-linked branches may be present. Amylose molecules may comprise between 200–6000 anhydroglucose units, varying between different starch types. Amylose constitutes about 15%–30% of common native starches. Amylose content in the different starch ranged from 28.8%-28.3%. The general low content of amylose in these samples indicates that when these starches are incorporated into food products, swelling of starch will be enhanced [9]. However, previous studies have reported comparatively higher values for amylose content in *D. alata*, although varieties investigated were not specified. Amylose/amylopectin ratio gives specific characteristics and functionality to starches by determining the texture and nature of their products [10].

The swelling power for the different samples is as follows 8.2<9.3<10.4<11.1 with sample A having the least swelling power among all tested starches. Swelling power provides evidence of the magnitude of interaction between starch chains within the amorphous and crystalline domains and also evidence of association bonding within the granules of yam starches. The higher the swelling index, the lower the associative forces. Water binding capacity is important in texture and quality of some foods since they stabilize starches against effects such as syneresis, which sometimes occur during retorting and freezing [11]. Water binding capacity of the tested starch samples ranged from 168.2% - 183.2% with sample A having the least water binding capacity.

4 CONCLUSION

Conclusively, results obtained in this study shows that the different varieties of yam consumed in Ozoro town contains starch with good physicochemical properties (Moisture, Ash content, Bulk density, Amylose, Swelling power and water binding capacity). These yams can also serve as alternate sources of starch based on their unique characteristics and thus, can be used for diverse products. The extracted starch may be used in the industries or for food products that require thick paste, high gel strength and elasticity.

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