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Effect of Various Processing Methods on the Pasting and Functional Properties of Aerial Yam (*Dioscorea bulbifera*) Flour

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Authors' contributions

This work was carried out in collaboration between both authors. Author ILP-O designed the experiment, carried out some of the analysis and prepared the final manuscript while author NCE carried out the functional properties and literature review. Both authors read and approved the final Manuscript.

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Original Research Article

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ABSTRACT

Aims: To determine the effects of various processing methods on the pasting and functional properties of Aerial yam (*Dioscorea bulbifera*) flour.
Place and Duration: Department of Food Science and Technology, Michael Okpara University of Agriculture, Umudike, between June 2012 and November 2012.
Methodology: Red and green cultivars of *Dioscorea bulbifera* were given tree treatments: boiling (1:10 w/v for 30 mins), roasting, soaking in 0.2% sodium Meta bisulphite (1:10 w/v for 7 hours), and untreated sample (control). Each of the samples was processed into flour. Pasting and functional properties of the flour samples were determined using standard methods.
Results: Boiling, roasting and soaking significantly ($p \leq 0.05$) affected the pasting properties of the flour samples. Roasting, boiling and soaking significantly decreased ($p \leq 0.05$) final viscosity (319 to 126 g) and (331 to 145 g), Trough (225 to 70) and (239 to 67), Peak time (5.66 to 4.88) and

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(5.58 to 4.96), Peak viscosity (267.75 to 119.67) and (278.17 to 108.58) for green and red cultivar respectively. Roasting significantly ($p \le 0.05$) decreased the breakdown values of both cultivars while boiling significantly increased the breakdown values of the two cultivars. The various treatments significantly ($p \le 0.05$) decreased the amylose content and increased the amylopectin values. There was no significant difference ($p \le 0.05$) in the in the bulk density of the samples. The roasted red cultivar had the highest gelatinization temperature (80°C) and significantly ($p \le 0.05$) differed from the rest of the samples. Oil absorption Capacity ($p \le 0.05$) increased from 2.20 to 2.80 g and 2.30 to 2.80 g in green and red cultivars respectively.

Conclusion: Boiling, soaking and roasting affected the amylose and amylopectin ratio, pasting and functional properties of the flour samples. The functional and pasting properties of *Dioscorea bulbifera* studied showed that it can be used in both food and pharmaceutical industries.

Keywords: Dioscorea bulbifera; pasting properties; functional properties; flour amylase; amylopectin.

1. INTRODUCTION

Yam is currently the fourth most important tuber-root crop in the world, after potato (*Solanum tuberosum* L,), cassava (*Manihot esculenta* Crantz), and sweet potato (*Ipomoea batatas* L.) [1]. In the tropics, yam is usually consumed as a staple food. It (yam) is highly valued in south eastern Nigeria where it is used for cultural and traditional purposes such as “New Yam festival and Traditional Marriage Ceremonies”. The Dioscorea species has long been cultivated for their medicinal properties (sapogenin steroids, used in production of cortisone and synthetic hormones) in the following order of importance: *D. bulbifera, D. cayenensis, D. dumentorum, D. alata, D. trifida, D. laxiflora and D. microbotrya* [2]. The *Discorea bulbifera* is a vigorous climber plant native of west Africa [3], cultivated for their bulbils which are consumed once cooked like potatoes in water with oil or roasted with local sauce (a combination of palm oil and other local spices).

Nigeria is the world’s largest producer of yam with an aggregate annual output in excess of 50% of total world production [4]. About 50-60 species of yam (*Dioscorea* spp.) are found in Nigeria but only 5 or 6 species are important as food [5]. Unfortunately, some of these food crops have been under-exploited for their food values, for example, *Dioscorea bulbifera*. [5]. *Dioscorea bulbifera* is native to Africa and Asia and is commonly known as “air potato” [6].

Dioscorea bulbifera has been widely used in the Chinese medical system as a valuable herb in the process of rebuilding and maintaining kidney function [6]. This herb was also found to have a beneficial effect in treating diseases of the lungs and spleen, and many types of diarrhea, improving digestion and metabolism [7]. In Asia, this herb has been highly recommended for treating diabetes disorder. It has been traditionally used to lower glycemic index, providing a more sustained form of energy and better protection against obesity and diabetes; however, this property has not yet been scientifically proven [8].

Yams (*Dioscorea bulbifera*) have not been processed to any significant extent commercially, Only a small portion of the crop is processed into instant yam flour which is particularly popular in Yoruba speaking areas of West Africa but less so in other parts of the continent [9].

In recent times, the increasing urbanization in different countries of Africa is changing the food habits and preferences of the population towards convenience food. Such food includes: Bread, Noodles, and other baked products that do not need further preparation which are basically based on wheat flour.

In Nigeria, there has been increased wheat importation because the crop is not grown in Nigeria and the production can supply only a small percentage of the requirement. Importation can be reduced tremendously by partial or complete substitution of wheat flour with flour from crops that are locally produced such as root and tubers: yam, cassava and sweet potato, and cereals: maize, rice sorghum and millet [10].

Processing Aerial yam to flour, can help to reduce the over dependent on wheat flour for our baked products and post – harvest losses.

2. MATERIALS AND METHODS

The two different cultivars of aerial yam; red and green used in the research were purchased from Nsukka local government area of Enugu State, Nigeria.

2.1 Sample Preparation

The sample preparation was carried out at the food science and technology laboratory Michael Okpara University of Agriculture Umudike Umuahia, Abia State, Nigeria. Reagents used were of analytical grade.

Two cultivars of *Discorea bulbifera* (green and yellow cultivars) was used for this study. Four treatments were given to the two different cultivars of the aerial yam (*D. bulbifera*). Each of the cultivar was divided into four portions, one portion was soaked, the other boiled, the third roasted, while the fourth (control) was just peeled, washed and sliced. The details of the sample preparation are illustrated in Fig. 1 below.

2.2 Determination of Functional Properties

2.2.1 Bulk density

The bulk density of the aerial yam flour was determined using the method described by [11]. The aerial yam flour sample was filled in a ten mil (10 ml) dried measuring cylinder and the bottom of the cylinder was tapped several times on the laboratory table until there was no further diminution of the sample level after filling to 10 ml mark.

Calculation:

$$\text{The bulk density (g/m)} = \frac{\text{Weight of sample (g)}}{\text{Volume of sample}}$$

2.2.2 Water absorption capacity

The water absorption capacity was determined using the method described by [11].

Ten ml (10 ml) of distilled water was mixed with one gram (1 g) of the aerial yam flour sample in a mixer and then homogenized for 30 seconds and allow to stand at room temperature for 30 minutes and centrifuged at 5000 rpm for 30 minutes. The volume of the supernatant (free water) in a graduated cylinder was noted. The amount of water absorbed (total minus free) was multiply by its density for conversion to grams. Density of water was assumed to be 1 g/ml.

$$\text{Water absorption capacity} = \frac{V_1 - V_2 \times \text{density of water}}{W}$$

Where:

V_1 = Initial volume of water (10 ml)
V_2 = Final volume after centrifugation
W = weight of sample (1 g)

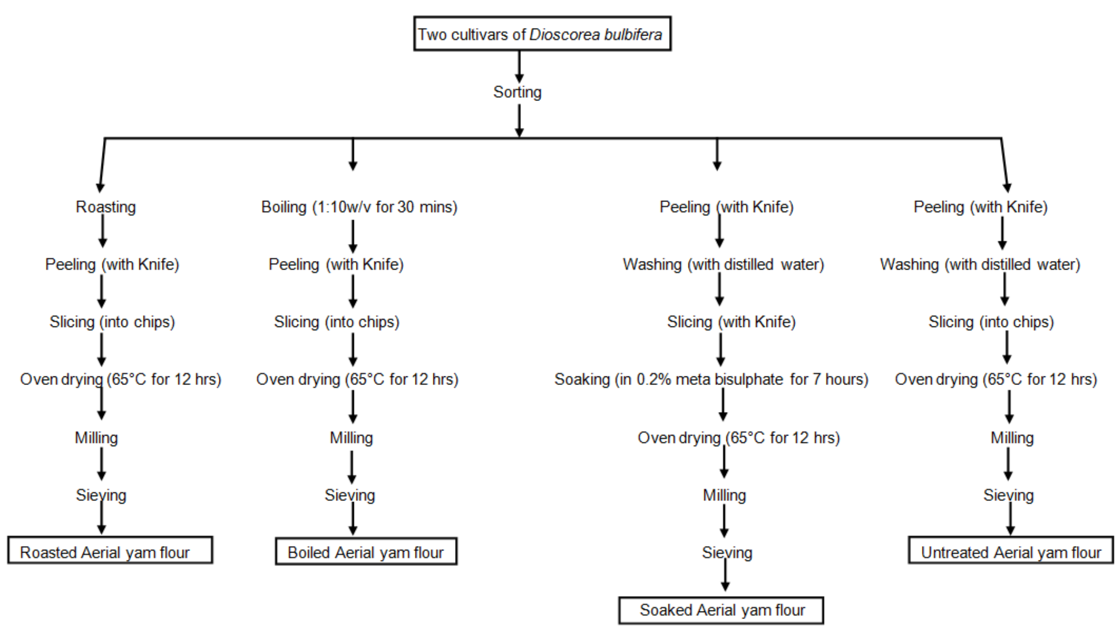

Fig. 1. A flow chart showing the production of flour from the two different cultivars of aerial yam, (*Dioscorea bulbifera*) with different treatment

2.2.3 Oil absorption capacity

This was determined using the method as described by [11].

Exactly one gram (1 g) of aerial yam flour sample was mixed with 10 ml of vegetable oil. The oil and flour sample was mixed and then homogenized for 30 seconds and allowed to stand for 30 minutes at room temperature and then centrifuged at 5,000 rpm for 30 minutes.

The volume of free oil (supernatant) was noted directly from the graduated centrifuge tube.

The amount of oil absorbed (total minus free) was multiplied by its density for conversion to grams.

Density of oil was taken to be 0.88 g/ ml for bleached palm oil.

$$\text{Oil absorption capacity} = \frac{V_1 - V_2}{W} \times \text{density of oil}$$

V_1 = Initial volume of oil
V_2 = Final volume after centrifugation
W = Weight of sample.

2.2.4 Wettability

The wettability of the sample (aerial yam flour) was determined according to the method of [11]. Exactly one gram (1 g) of the sample was added into a 25 ml graduated cylinder with a diameter 1cm and a finger was placed over the open end of the cylinder. The cylinder was inverted and dumped at the height of 10 cm from the surface of a 600 ml beaker containing 500 ml of distilled water. The finger was removed to allow the test material to be dumped.

2.2.5 Swelling index

Two grams of aerial yam flour sample was weighed into 10 ml measuring cylinder and the volume it occupied was recorded as (V_1), distilled water (27ºC) was added until the 10 ml mark was reached. The cylinder containing the samples and distilled water was left to stand for 45 min after which a new volume V_2 was recorded. The swelling index was expressed as the ratio of the final volume over that of the initial volume.

$$\text{Swelling index} = \frac{\text{Volume occupied by sample after swelling}}{\text{Volume occupied by sample before swelling}}$$

2.2.6 Gelation temperature

This was determined according to method described by [11].

10% suspension of the aerial yam flour sample was prepared in a test tube and heated in a boiling water bath, with continuous stirring. The gelation temperature (GT) was taken as that temperature recorded 30 seconds after gelatinization was visually noticed.

2.2.7 Viscosity

This was also determined using the method described by [11].

Ten percent (10%) of the aerial yam flour was suspended in a distilled water and mechanically stirred for 30 minutes at room temperature and Surgiefriend viscometer was used to measure the viscosity.

2.3 Pasting Properties

The pasting properties were determined using a Rapid Visco Analyzer [12].

Exactly 3.5 grams of the flour sample was weighed and dispensed into the test canister 25.0 ml of distilled water was dispensed into the canister containing the sample. The solution was thoroughly mixed and the canister was well fitted into the RVA (Rapid Visco-Analyser), the slurry was held at 50ºC for 1 min, heated to 95ºC for 8 min and cooled back to 50ºC within 8 min, rotating the can at a speed of 160 rpm with continuous stirring of the content with a plastic paddle. The parameters evaluated were peak viscosity, setback viscosity, final viscosity, pasting temperature and time to reach peak viscosity.

The Visco analyzer was switched on and the pasting performance of the flour was automatically recorded on the graduated sheet of the instrument.

2.4 Determination of Amylose/ Amylopectin Ratio

The method described by [13] was used.

Exactly two grams (2 g) of the starches was suspended in 50 ml distilled water. A butanol-water mixture solution (1: 9 v/v) was added with continuous stirring and heating to boiling. Butyl and amyl alcohol (1:1) was added to the boiling suspension which was then allowed to cool in a cold water bath. The supernatant liquor was decanted and the microcrystalline precipitate formed was washed repeatedly with butanol saturated with water, dried in oven and weighed. The procedure was repeated twice and the mean value noted as the ratio of amylose. The supernatant was precipitated with excess methanol and the precipitated was dried in an oven and weighed to determine the ratio of amylopectin.

2.5 Statistical Analysis

The test data generated from the sensory evaluation was subjected to analysis of variance (ANOVA) using SPSS version 17.

3. RESULTS AND DISCUSSION

3.1 Pasting Properties of Aerial Yam (*Dioscorea bulbifera)* Flour Samples

The result indicate that the control Red cultivar had the highest values of peak viscosity (278.17±0.01 RVU), Trough (239.17±0.01 RVU), Final viscosity (331.42±0.01 RVU) and Pasting temperature (85.12±0.00ºC) and these values are significantly (P≤ 0.05) higher than the corresponding values obtained as summarized in Table 3.1. The highest pasting temperature values obtained in the control Red cultivar may be attributed to difference in the genetic makeup, or length of storage [14].

The highest value of the Break down viscosity was obtained in the boiled Green cultivar (48.75±0.01 RVU) and this value is significantly (P≤ 0.05) higher than values obtained in soaked Green (41.08±0.01 RVU) and Red (48.42±0.01 RVU) cultivars, roasted Green (22.08±0.00 RVU) and Red (37.92±0.01 RVU) cultivars as well as the control Green (42.17±0.01 RVU) and Red (39.00±0.00 RVU) cultivars respectively. The results from this study show that roasting and soaking increased the breakdown viscosity which was a desirable characteristic. The higher the breakdown value, the higher the ability to remain undisrupted when subjected to long period of constant high temperature and ability to withstand break down during cooking.

Indeed the highest set back value was obtained in the Roasted Red cultivar (124.08±0.00 RVU) which is significantly (P≤ 0.05) higher than values obtained in Boiled Green (55.58±0.01 RVU) and Red (102.42±0.01 RVU), the soaked Green (99.00±0.00 RVU) and Red (60.17±0.01 RVU) cultivars as well as the control Green (93.58±0.00 RVU) and Red 992.25±0.02 RVU) cultivars. Higher set back values are synonymous to reduced dough digestibility [15] while lower setback during the cooling of the paste indicates lower tendency for retro gradation [16].

The values decreased from 225.58 to 70.93 RVU and 239.17 to 67.69 RVU for green and red cultivars respectively. This hold-period is often associated with breakdown in viscosity [17]. Roasting and boiling significantly decreased the hold-period (trough) of the samples. It is an indication of breakdown or stability of the starch gel during cooking [18]. The hold-period sometimes called holding strength, hot paste viscosity or trough due to the accompanied breakdown in viscosity is a period when the sample was subjected to a period of constant temperature (usually 98ºC) and mechanical shear stress. It is a minimum viscosity value in the constant temperature phase of the RVA profile and measures the ability of paste to withstand breakdown during cooling [12].

There was a significant decrease in the cooking time with the cultivars and the various treatments of the *Dioscorea bulbifera* flour. The control green cultivar recorded the highest value of the peak time (5.66 min) followed by the untreated (control) red (5.58 min), but the cooking time reduced significantly with the various treatments with boiled green recording the highest decrease in time (4.88 min) followed by soaked green sample (4.97 min). The peak time is a measure of cooking time [19].

The red cultivar (untreated) had the highest final viscosity (331.42 RVU), followed by the green cultivar (untreated), while the red cultivar soaked sample recorded the least final viscosity. The final viscosity of control red cultivar (331.42 RVU) significantly differed from other flour samples. Final viscosity is the commonly used to determine a particular starch based sample quality and from the result control red cultivar (331.42 RVU) and control green cultivar (319.17 RVU) seemed to be the best. [20] has reported the use of starches with high viscosity value in pharmaceutical companies especially, as tablet binders. Starches of aerial yam “control red”, “control green”, “boiled red”, “boiled green” (331.42, 319.17, 247.33 and 229.33 RVU respectively) could be found applicable in pharmaceutical industries.

3.2 Amylose and Amylopectin Ratio of *Dioscorea bulbifera* Flour

The result of the amylose/amylopectin ratios of the samples as summarized in Table 3.2 ranged from 18.24:81.76% to 29.40:70.60% with roasted green sample recording the least value of amylose and highest value of amylopectin while the red (control) sample had the highest amylose content and least value of amylopectin. There were significant difference ($p \leq 0.05$) among the samples. The overall result shows that the various treatments significantly ($p \leq 0.05$) decreased the amylose content and increased the amylopectin values These variations could be attributed to genetic variation, treatments, level of maturity at harvest and storage time [21,22]. The result obtained in this study did not vary significantly from the ratio of 19:81% for maize starch and 24:76.33% for kaffir, reported by [23]. The retrogradation tendency of starch also depends on the amylose/amylopectin ratio. Generally, the higher the concentration of amylose in a given starch/flour, the higher its tendency towards retrogradation. Since it (retrogradation) occurs as a result of mutual alignment of amylose molecules, expulsion of water, and formation of the new intermolecular forces [24]. The respective proportion of amylose/amylopectin determine their behaviors during the cooking process [25] and suitability for certain industrial applications such as the manufacture of protective films and thickening agents [26,27].

3.3 Functional Properties of *Dioscorea bulbifera* Flour

The result of the interaction on the functional properties between the two cultivars and treatment of the *Dioscorea bulbifera* are shown in Table 3.3.

3.3.1 Bulk density

The roasted green sample recorded highest bulk density (0.52 g/ml) while the control red sample recorded the lowest value of bulk density (0.46 g/ml). The result indicates that there was no significance difference ($P \leq 0.05$) among the various samples and the control. This means that the treatment given to the two (2) cultivars of *Dioscorea bulbifera* flour sample has no effect on their bulk density. The result obtained in this study is in conformity with the value (0.53 g/ml) recorded by [28], it was similar with the value obtained in bread fruit starch (0.67 g/ml) [29].

Bulk density is dependent upon the particle size of the sample. Bulk density is a measure of heaviness of a flour sample. It is important for determining packaging requirements, material handling and application in wet processing in the food industry [30]. Flours with high bulk density are used as thickeners in food products while those of low bulk density will be an advantage in the bulk storage and transportation of the flour [31]. Low bulk density is advantageous for the infant as both calorie and nutrient intake is enhanced per feed of the child [32]. The flours of *Dioscorea bulbifera* can be found applicable where both low and high bulk density are required since it fells in between high and low values of bulk density.

3.3.2 Water absorption capacity

The highest values of the water absorption capacity (4.80±0.14 g/g) and oil absorption capacity (3.20±0.01 g/g) was obtained in the boiled Red cultivar and these values were significantly ($P \leq 0.05$) higher than values obtained in Roasted, Soaked and Control Green and Red cultivars. The result obtained here vary slightly from that (3.50 g/g) reported by [28], and was higher ($P \leq 0.05$) than that of unripe plantain (1.25 g/g) recorded by [33]. Variations in the results recorded in this study and also with other researchers could be as a result of method of analysis, differences in cultivar and also treatments given to them. Water absorption capacity may assure product cohesiveness [34]. High water absorption capacity is an indication of its use in composite flour for bread making. Water absorption capacity is considered critical in viscous foods such as soups and gravies; thus, the flour may find use as functional ingredients in soups, gravies and baked products [35]. Flours of *Dioscorea bulbifera* can be found applicable in this area since it has a high water absorption capacity.

3.3.3 Oil absorption capacity

The result of the oil absorption capacity ranges from (2.2 g/g) to (3.2 g/g). The results obtained showed that various treatments given to these two cultivars of *Dioscorea bulbifera* flour sample increases their oil absorption capacity and this suggest that the flour of *Dioscorea bulbifera* can be useful in food preparations that involves oil mixing like bakery products where oil is an important ingredient.

Table 3.1. Effect of processing on the pasting properties between the two cultivars aerial yam (*Dioscorea bulbifera)*

Treatment	Cultivar	Peak viscosity	Trough	Break down	Final viscosity	Set back	Peak time	Pasting temp
Control	Green	267.75±0.01^{b}	225.58±0.01^{b}	42.17±0.01^{c}	319.17±0.01^{b}	93.58±0.00^{e}	5.66±0.01^{a}	83.25±0.00^{e}
	Red	278.17±0.01^{a}	239.17±0.01^{a}	39.00±0.00^{f}	331.42±0.01^{a}	92.25±0.02^{f}	5.58±0.00^{b}	85.12±0.00^{a}
Boiled	Green	119.67±0.02^{f}	70.92±0.01^{g}	48.75±0.01^{a}	126.50±0.01^{h}	55.58±0.01^{h}	5.25±0.01^{d}	84.45±0.01^{b}
	Red	108.58±0.01^{g}	67.67±0.01^{h}	40.92±0.01^{e}	170.08±0.01^{f}	102.42±0.01^{c}	4.96±0.01^{f}	82.55±0.01^{f}
Soaked	Green	128.50±0.00^{e}	87.42±0.01^{e}	41.08±0.01^{d}	186.42±0.01^{e}	99.00±0.00^{d}	4.97±0.01^{f}	83.59±0.01^{d}
	Red	133.50±0.02^{d}	85.08±0.01^{f}	48.42±0.01^{b}	145.25±0.01^{g}	60.17±0.01^{g}	5.48±0.01^{c}	82.45±0.00^{g}
Roasted	Green	128.50±0.00^{e}	106.42±0.01^{d}	22.08±0.00^{h}	229.33±0.02^{d}	122.92±0.01^{b}	4.88±0.02^{g}	83.26±0.01^{e}
	Red	161.17±0.01^{c}	123.25±0.01^{e}	37.92±0.01^{g}	247.33±0.02^{c}	124.08±0.00^{a}	5.18±0.01^{e}	84.05±0.01^{c}

**Means with the same superscripts within each column are not significantly different (P=.05)*

Table 3.2. Amylose/amylopectin ratio between of two cultivars of aerial yam (*Dioscorea bulbifera)*

Treatment	Cultivar	Amylose	Amylopectin
Control	Green	26.32^{b}±0.025	73.68^{g}±0.028
Control	Red	29.40^{a}±0.071	70.60^{h}±0.071
Roasted	Green	18.24^{h}±0.085	81.76^{a}±0.113
Roasted	Red	19.45^{g}±0.354	80.58^{b}±0.007
Soaked	Green	24.60^{d}±0.028	75.40^{e}±0.255
Soaked	Red	25.72^{c}±0.141	74.28^{f}±0.771
Boiled	Green	22.76^{f}±0.156	77.24^{c}±0.014
Boiled	Red	23.62^{e}±0.311	76.38^{d}±0.127

**Means with the same superscripts within each column are not significantly different (P≤ 0.05)*

Table 3.3. Functional properties of two cultivars and treatments of aerial yam (*Dioscorea bulbifera)*

Treatment	Cultivar	Bulk density (g/ml)	WAC (g/g)	OAC (g/g)	Viscosity (Mpa/s)	Swelling index	Wettability (S)	Gelatinization temp. (°C)
Control	Green	0.49^{a}±0.028	3.70^{c}±0.282	2.20^{c}±0.141	96.70^{d}±0.000	2.60^{c}±0.141	158.00^{c}±0.282	78.00^{bc}±0.000
Control	Red	0.46^{a}±0.014	3.80^{bc}±0.141	2.30^{c}±0.141	97.80^{bc}±0.000	2.50^{c}±0.141	159.00^{c}±0.414	76.00^{c}±1.414
Roasted	Green	0.52^{a}±0.056	4.00^{bc}±0.000	2.80^{b}±0.141	112.00^{b}±1.414	3.20^{a}±0.000	17.00^{e}±1.414	80.00^{ab}±1.414
Roasted	Red	0.49^{a}±0.014	4.20^{b}±0.141	2.80^{b}±0.000	114^{a}±0.000	3.00^{ab}±0.141	37.00^{d}±1.414	82.00^{a}±1.485
Soaked	Green	0.49^{a}±0.014	3.80^{bc}±0.282	2.50^{bc}±0.282	98.30^{c}±1.414	2.40^{c}±0.141	180.00^{b}±2.828	79.00^{bc}±1.414
Soaked	Red	0.49^{a}±0.014	3.90^{bc}±0.000	2.35^{c}±2.35	98.50^{c}±0.000	2.50^{c}±0.283	270.00^{a}±7.071	78.00^{bc}±1.414
Boiled	Green	0.47^{a}±0.042	4.00^{bc}±0.000	2.45^{c}±0.071	96.70^{d}±0.000	2.65^{c}±0.141	9.00^{f}±0.000	79.00^{bc}±1.414
Boiled	Red	0.47^{a}±0.014	4.80^{a}±0.141	3.20^{a}±0.000	98.20^{c}±0.000	2.70^{bc}±0.071	11.00^{ef}±1.414	78.00^{bc}±0.000

**Means with the same superscripts within each column are not significantly different (P=.05)*

3.3.4 Wettability

The highest time of wettability was obtained in the soaked Red cultivar (270 sec) while the lowest time of wettability was observed in the Boiled Green cultivar (9 sec). The result obtained from this study shows that the various treatment given to these two cultivars reduced their wettability time except flour samples from soaked green and red cultivars. Wettability is a function of the ease of dispersion /displacement of water by any sample.

The sample with the lowest time of wettability will dissolve in water faster and would perform better in texture and comminuted meats and baked products [35].

3.3.5 Swelling index

The highest value of swelling index was obtained in Roasted green cultivar (3.20) which is statistically equal to the value obtained in Roasted Red cultivar (3.00) but significantly ($P\leq 0.05$) different from values obtained in boiled, soaked and control green and red cultivars. It could be deduced that the various treatment given to these two cultivars of *Dioscorea bulbifera* increases their swelling index except soaking that reduces the swelling index of the various cultivars respectively. High swelling capacity has been reported as part of the criteria for a good quality product [36]. This implies that roasting and boiling of *Dioscorea bulbifera* can be a factor that contribute to the good quality of product made from the yam.

3.3.6 Gelatinization temperature

The gelatinization temperature ranges from 76ºC to 82ºC with roasted red sample (82ºC) recording the highest value with the control red cultivar (76ºC) had lowest gelatinization temperature. The various treatment given to samples increased their gelation temperature. Variation seen in the gelatinization temperature /properties may be attributed to the ratio of different constituents such as protein, lipids and carbohydrate [19].

3.3.7 Viscosity

The viscosity of the yam flour ranged from (96.7 mpa/s) to (114 mpa/s) with roasted red cultivar having the highest viscosity (114 mpa/s), while the control green and boiled green cultivars had the lowest value of (96.70) respectively. From the treatments given to these two cultivars of *Dioscorea bulbifera* flour, it was observed that the various processing methods increased the viscosity of *Dioscorea bulbifera* flour samples which implies that the samples can be utilized in food product that require high viscosity characteristics.

4. CONCLUSION

The result of the study showed that Aerial yam (*Dioscorea bulbifera)* had an array of good starch contents, functional and rheological properties which indicated a wider potential for utility of the flour in the food industry as thickeners, drug/ tablet binders in the pharmaceutical industries. Aerial flour can be used as composite flour in the production of cookies. The flour may help reduce over dependent on wheat flour for our baked products, reduce post-harvest losses of aerial yam.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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