

## Comparative Study on Nutritional and Anti nutritional Composition of three Cultivars (red, green and yellow) of Aerial Yam (*Dioscorea bulbifera*)

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**Abstract:** Nutritional and anti-nutritional composition of three cultivars (red, green and yellow) of aerial yam (*Dioscorea bulbifera*) were studied. The nutritional composition studied includes; proximate composition, mineral and vitamin content of the three cultivars. The red cultivar had the highest moisture, carbohydrate and ash content (7.71%, 77.41%, and 3.97% respectively). The protein content (9.62%) of the green cultivar was significantly higher than that of the red (6.82%) and yellow (7.27%) cultivars. The green cultivar also had the least crude fibre (1.63%) and fat (0.37). The yellow cultivar had the highest crude fibre (2.45%) and crude fat (4.15%) content. The Manganese (100.02mg/100g) and sodium (2403.0mg/100g) content of the red cultivar was significantly higher than that of the yellow and green cultivars. However, the yellow cultivar had the highest potassium 667.53mg/100mg and the least sodium (87.25mg/100g) content. The vitamin content of the cultivars varied from 137.24 -700.88mg/100g). The red cultivar had the highest vitamin A content (700.88mg/100g) while the yellow cultivar had the least value (137.24mg/100g). The saponin (14.03mg/100 g), oxalate(12.60mg/100g) and tannin(0.22mg/100g) were highest in the green cultivar while the red cultivar had the least saponin and oxalate content, 5.46mg/100g and 9.00mg/100g respectively.

**Keywords:** anti nutritional composition, *Dioscorea bulbifera*, mineral, proximate composition, vitamin.

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### I. Introduction

Roots and their tuber crops such as yams, cassava, cocoyam and sweet potatoes rank next in importance to the cereal grains in providing the major part of the daily caloric needs of people in the tropics [1].

Yams make a major contribution to the Nutrition of West Africans as a source of carbohydrate, before the introduction of cassava and sweet potatoes. They have been very important in times of famine [2]. The genus *Dioscorea* contains a wide range of species used as food (about 600 species) although the edible yams are derived from only about ten [2]. White or guinea yam (*D. rotundata* Poir) is the most popular species in Africa but yellow yam (*D. cayenensis* Lamk), water yam (*D. alata* L.) and cluster yam (*D. dumetorum* Pax) are also grown extensively. However, Aerial yam (*D. bulbifera* L.) and Chinese yam (*D. esculenta*) are less important and are grown in little quantity [2].

Yam is a premium crop in the Nigerian food system and Nigeria is the world's largest producer with an aggregate annual output in excess of 50% of total world production [3]. Unfortunately, some of these food crops have been under exploited for their food values examples *Dioscorea bulbifera* and *Dioscorea dumetorum* [3].

Aerial yam and yams in general are eaten boiled or fried or even roasted though Aerial yam (the wild form) is generally feared to cause madness and in effect is inedible [4]. Work on yams and other tropical root tuber crops have been generated in the last 10-15 years through the formation and subsequent activities of the international society for tropical root crops [5]. In Nigeria, government awareness of the need to increase food production for feeding the teeming population has lent support for studies on better methods of tuber and root crops production.

Currently, a large number of research are being carried out on root and tuber crops in research institutes and in Universities. Improvement on the processing method and utilization of this crop (*D. bulbifera*) will reduce food insecurity in Nigeria. *D. bulbifera* has been sidelined over the years and is going extinct as a result of its poisonous characteristic. While there are various methods by which this crop can be made safe for consumption, a properly scientifically researched method is yet to be known and publicized.

Food processing is an important aspect of agricultural production and marketing; it adds value, removes anti-nutritional components increases the nutritional value of foods thereby converting them into a form that is more acceptable. The study focuses on the nutritional and anti-nutritional components of the three cultivars of aerial yam (*D. bulbifera*) thereby converting them into a form that is readily available and more acceptable.

## II. Materials And Methods

### 2.1 Source of Raw Materials

Three cultivars (red, green & yellow) of *Dioscorea bulbifera* was purchased from Nsukka LGA in Enugu state. Three hundred grams of *D.bulbifera* was peeled, washed, and sliced, after which they were put into an oven at 55°C for 12 hours to dry, after which they were milled into powder using a blender and then packed in an air tight container until they were used for analysis.

The flour produced from each cultivars were taken to the laboratory for the following analysis: proximate composition; (moisture, Ash, crude fiber, protein, fat, carbohydrate): vitamins, minerals, and anti-nutritional factors determination (oxalate, saponins, phenols and tannins).

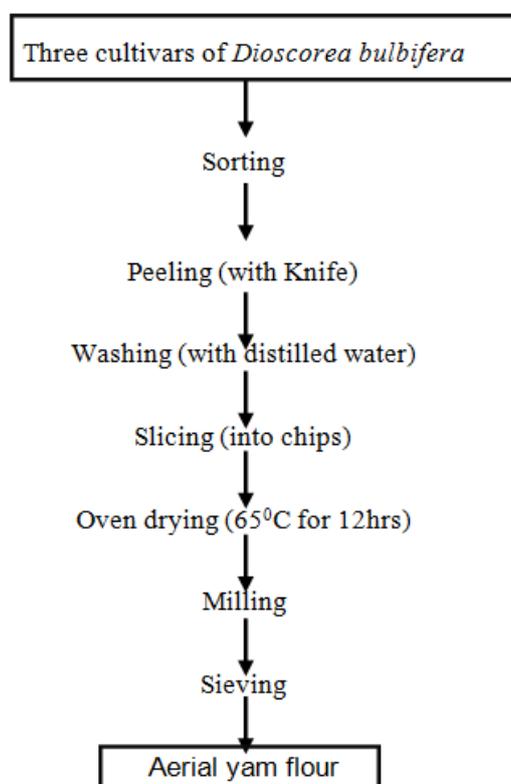


Fig. 1: A flowchart for the production of flour from three different cultivars of *Dioscorea bulbifera*.

### 2.2 Analysis

The proximate analysis and mineral content analysis of the different cultivars of *Dioscorea bulbifera* were carried out at the Animal science laboratory, Obafemi Awolowo University Ile Ife, the mineral content were analysed at the central science laboratory also at the Obafemi Awolowo University Ile Ife, while the vitamins and anti-nutritional factors analysis were carried out at the Biochemistry Laboratory, Federal University of technology Akure.

#### 2.2.1 Proximate analysis

The crude protein, ash, moisture was determined by kjeldhal method as described by AOAC.[6].

#### Crude Fibre Determination

The crude fiber was determined by the Weende method as described by James. [7]. Exactly 2g of each sample was defatted. The defatted sample was boiled in 200ml of 1.25% Tetra Oxo Sulphate (VI) solution under reflux for 30 minutes. After that the sample was washed with hot water, using a two-fold muslin cloth to trap the particles, the washed sample was transferred quantitatively back to the flask and boiled again in 200ml of 1.25% sodium hydroxide solution for 30 minutes and washed before it was transferred to a weighed porcelain crucible and dried in the oven at 105°C for three hours. After cooling in a desiccator it was re-weighed.

The percentage crude fiber was calculated as follows

$$\% \text{ crude fibre} = \frac{W_2 - W_3}{W_1} \times 100$$

Where:

W1 = weight of sample

W2 = weight of sample + crucible

W3 = weight of crucible + ash

The carbohydrate content of the sample was determined by estimation using arithmetic difference.

% CHO = 100 - (% moisture + % protein + % ash + % fat content + % Crude fiber)

### 2.2.2 Determination of Vitamins

#### Vitamin A determination A

Vitamin A was determined using the spectrophotometric method. A quantity of the weighed sample that contained not more than 1g fat and less than 300 unit of Vitamin A were mixed with 30ml of absolute alcohol and 300 unit of 50% potassium hydroxide and was brought to boil gently under the flux for 30 minutes in stream of oxygen free nitrogen. It was cooled rapidly and 30ml of water was added, and then it was transferred to a separator wash in with 3 × 50ml petroleum ether. The vitamin A was extracted by shaking for 1min after which the separation was completed and the lower layer discarded and the extract was washed with 4 × 50ml water. The wash down was then evaporated to about 5ml and the remaining ether was removed in a stream of nitrogen at room temperature. The residue was dissolved in sufficient isopropyl alcohol to give a solution containing 9-15 units per ml and the extinctions were measured at 300, 301, 325, 334 nm and the wavelength of maximum absorption.

The calculation is as follows

$E_{325}$  (corrected) = 6.815

$E_{3.25 - 2.555}$

$E_{310 - 4.260}$

$E_{334}$  Potency (units/g) = 1830 × E1% at 325nm (corrected)

#### Determination of Vitamin C (Ascorbic Acid)

Exactly 5g of the sample was weighed into an extraction tube and 100ml of EDTA (TCA (2:1) extracting solutions were mixed and the mixture was shaken for 30 minutes. 200micro liter was pipette and mixed with 300 micro liter at 13.3% of TCA and 74 micro liter of DNPH the mixture was incubated at 37°C for 3 hours then, 65% H<sub>2</sub>S<sub>4</sub> was added and the absorbance was read at 520nm. The ascorbic acid standard was used as a reference compound.

### 2.2.3 Determination of Anti-nutrients

#### Determination of Oxalate

Exactly 1g of the sample was weighed into 100ml conical flask. 75cm<sup>3</sup> of 3m H<sub>2</sub>SO<sub>4</sub> was added and the solution was carefully stirred with a magnetic stirrer for about 1 hour then filtered using whatman No1 filter paper. 25cm<sup>3</sup> of the sample filtrate (extract) was then collected and titrated hot (80°C - 90°C) against 0.05 MnO<sub>4</sub> solution to the point when a faint pink color appeared then persisted for at least 30 seconds [8].

#### Determination of Saponin

The spectrophotometric method of Bruner (1984) was used for saponin determination. [9]. Exactly 2g of the sample was put into a 250ml beaker and 100ml of ISO butyl alcohol added. A shaker was used to shake the mixture for 5 hours to ensure uniform mixing. The mixture was then filtered using the No.1 Whatman filter paper into a 100ml beaker containing 20ml of 40% saturated solution of magnesium carbonate (MgCO<sub>3</sub>). The mixture obtained was filtered again through No1 filter paper to obtain a clean colorless solution was taken to a 500ml volumetric flask using a pipette made to mark with the distilled water. It was allowed to stand for 30minutes for the need color to develop. The absorbance was read after the color development on the spectrophotometer at 350nm.

$$\text{Saponin} = \frac{\text{Absorbance of sample}}{\text{Conc. of sample}} \times \text{Absorbance of Stan.}$$

#### Tannin Determination

The method of Pearson (1976) was used. [10] Exactly 1g of each sample was weighed into a centrifuge tube with 2ml of distilled water. It was centrifuged at 1500rpm for 10 minutes. The centrifuge samples were then poured out into a beaker and the supernatant (extract) dispersed. One ml of NaCo<sub>3</sub> and Folin Denis reagent was added in the beaker and allowed to settle. Therefore, the readings were taken using a spectrophotometer. Tannin could be calculated as follows:

$$\% \text{ Tannin} = \frac{A_n}{A_s} \times \frac{C}{W} \times \frac{100}{V_a} \times V_f$$

$A_n$  = absorbance of test sample  
 $A_s$  = absorbance of standard sample  
 $C$  = concentration of standard solution.

### Determination of Phenols

The Follins method described by Pearson (1976) was used to determine the phenol content. [10] Exactly 0.2g of the dried sample was dispensed into a test tube. 10mls of methanol was then added to it and shaken thoroughly. The mixture was left to stand for 5 minutes before being filtered using Whatman filter paper number 4. 1ml of the extract was placed in attest tube and 1ml of Follins reagent was added to it with 5ml of distilled water was added to it with 5ml of distilled water. The color was allowed to develop for about 3 – 4 hour at room temperature. The absorbance of the developed color was repeated two more time. To get an average phenol content was calculated as:

$$\% \text{ phenol} = \frac{100 \times A_u \times C \times V_f \times D}{W \times A_s \times 100 \times V_a}$$

Where:

$W$  = Weight of sample analyzed  
 $A_u$  = Absorbance of the test sample  
 $A_s$  = Absorbance of standard solution  
 $C$  = Concentration of Standard in mg/ml  
 $V_f$  = Total filtrate volume  
 $V_a$  = Volume of filtrate analyzed  
 $D$  = Dilution factor where applicable.

### 2.2.4 Determination of minerals

The mineral content of each sample was determined by the dry ash extraction method following specific mineral element. [6] Exactly 2.0g of the sample was burnt to ashes in a muffle furnace at 500°C. After complete ashing, the ash was diluted with 1% Hydrochloric (Hcl) acid, then filtered into a 100ml standard flask, and made up to the mark with deionized water. The solution were read with AAS machine (model No: Analysis 400, Serial No 201510114102) for the determination of potassium, iron, magnesium .and sodium. All values were expressed in mg/100g.

### 2.2.5 Statistical analysis

The statistical analysis was carried out using STOCHASTIC FRONTIER FUNCTION and ANOVA using DUNCAN multiple Range test using SPSS 15.

## III. Results And Discussion

### 3.1 Proximate Composition of *Dioscorea bulbifera* Flour samples

The result of the proximate compositions of raw untreated samples (control) of the three cultivars (Green, Yellow, and Red) of the *Dioscorea bulbifera* are shown in TABLE 1.

The red cultivar had the highest moisture content (7.41%) which was significantly higher ( $P < 0.05$ ) than the moisture of green and yellow cultivars (7.16% and 7.42% respectively). The moisture content obtained in this study was similar to the value (7.029%) obtained by Ogbuagu, (2008)[4]. But differ slightly from the values (9.20%) obtained by Abara, (2011)[11]. This slight difference could be associated to the level of maturity, environmental factors, experimental method of analysis, level of maturity of the tuber and type of cultivar used [12] [13]. The low moisture content of the cultivar could enhance for its keeping or storage quality [14]. High moisture content reduced storage value.

The red cultivar had the highest ash content (3.97%), followed by the green cultivar which had an ash content of 3.79% while the yellow cultivar had the least ash content (2.51%). Ogbuagu, (2008) reported an ash content of 2.65% which was closer to the ash content (2.51%) of the yellow cultivar but slightly lower than the ash content of the green and red cultivars (3.770 and 3.975 respectively). The ash contents of the three cultivars were found to be higher when compared with earlier report of Abara et al., (2003) [13] who reported an ash content of 2.24%. The percentage of ash obtained in this study shows that *D.bulbifera* will be rich in minerals.

The crude fiber content (2.45%) of the yellow cultivar was significantly ( $P < 0.05$ ) higher than that of the red and green cultivars (1.879 and 1.635% respectively). Shanthakumari et al., (2008)[15] and Abara (2011)[11], reported fiber contents of 3.92g/100g and 2.89% which are higher than the values obtained in this

work. However, Ogbuagu, (2008) recorded fiber contents of 6.9 to 1.2% which were lower than our values [3]. This variation could be attributed to experiment methods, variety/cultivar used in the geographical locations, climate condition. Comparatively, the fiber contents of the three cultivars were higher than the fiber content of polished rice 0.2%. [16]. Fiber is essential in food as it absorbs water and provides roughage for the bowels, assisting intestinal transit.

The yellow cultivar had the highest fat content of (4.15%), followed by the red cultivar which had a fat content of (2.21%) while the green cultivar had the least fat content of (0.37%). Some researchers, [11] [3], Abara, (2011), Ogbuagu, (2008) reported a fat content of 0.49% and 0.70% which is closer to the fat content of the green cultivar Shanthakumani et al, (2008) reported a fat content of 3.92% which is closer to the ash content of the yellow cultivar but higher than the fat content of red and green cultivars. However, yams generally contain low levels of fat [17] [1]. The fats are mainly structural fats and are of limited nutritional importance. However, they contribute to the palatability of the crop.

The crude protein content (9.62%) of the green cultivar was significantly ( $p < 0.05$ ) higher than that of the red and green cultivar (6.82% and 7.27%) respectively. The crude protein content (6.82-9.62%) can be compared to those obtained by Abara (2011), and Ogbuagu (2008) of 6.35% and 9.28% respectively. These findings agreed with the results of Bell and Faiver (1981) [18] that indicated that protein ranges from 6-9%. Shanthakumari et al., (2008) [15] reported a crude protein content of 15.75% which is significantly higher than the values obtained in this work. The variation among the protein content of yams cultivar could be attributed to the variations in factors such as climate, maturity at harvest and length of storage time. These factors may be responsible for the differences observed in the crude protein content obtained in this work and those of other workers. The protein content of the samples varied from 6.82-9.62% and are comparably higher than reported values of 5.15% for white yam, 4.88% for water yam and 3.64% for sweet potato [16].

The red cultivar had the highest carbohydrate contents (77.41%) which was significantly higher ( $P < 0.05$ ) than the green and yellow cultivars (77.16 and 76.42%) respectively. The carbohydrate contents obtained in this study were similar to the value (79.15%) obtained by Ogbuagu (2008) [3], but differ slightly from the values (82.50) obtained by Abara (2011) [11]. The values obtained in this study were quite reasonable as the dry matter of most root crops is made up of about 60-90% carbohydrate [17].

The carbohydrate content of yams is affected principally by age of the tuber and by species and cultivar differences (Martin, 1979) [19] and these factors might be responsible for the observed variation in the carbohydrate content of *Dioscorea bulbifera*. The carbohydrate values were comparable to the carbohydrate contents of white yam, (78%), water yam, (75.65%) and sweet potato; 83.55% [20].

**Table 1: Proximate Composition Of *Dioscorea Bulbifera* Flour.**

Cultivars	Moisture (%)	Ash (%)	Crude Fiber (%)	Crude Fat (%)	Crude Protein (%)	CHO (%)
Green	7.16 <sup>c</sup>	3.77 <sup>b</sup>	1.63 <sup>c</sup>	0.37 <sup>c</sup>	9.62 <sup>a</sup>	77.16 <sup>b</sup>
Yellow	7.42 <sup>b</sup>	2.51 <sup>c</sup>	2.45 <sup>a</sup>	4.15 <sup>a</sup>	7.27 <sup>b</sup>	76.42 <sup>c</sup>
Red	7.71 <sup>a</sup>	3.97 <sup>a</sup>	1.87 <sup>b</sup>	2.21 <sup>b</sup>	6.82 <sup>c</sup>	77.41 <sup>a</sup>

Means of duplicates determination.

Means with the same superscripts within each column are not significantly different ( $p > 0.05$ )

Means without the same superscripts within each column are significantly different ( $p < 0.05$ )

### 3.2 Mineral Composition of *Dioscorea bulbifera* Flour Samples

The result of the mineral composition of three cultivars (Green, Yellow and Red) of raw (untreated samples/control samples) of *D. bulbifera* is shown in TABLE 2.

The red cultivar had the highest manganese content (100.02mg/100g) which was significantly higher ( $P < 0.05$ ) than the green and yellow cultivar (25.03 and 75.02mg/100g respectively). The manganese content obtained in this study (25.03mg/100 to 100.02mg/100) was relatively different from the value obtained by [15] who reported a manganese value of 5.36mg/100g. Manganese is involvement in a number of enzyme systems [11]. The disparities observed in the mineral content of *Dioscorea bulbifera* had been explained as due to environmental factors as well as experimental method of analysis [21].

The yellow cultivar had the highest potassium content (667.53mg/100g) is significantly the red cultivar which had 467.53mg/100g while the green cultivar had the least potassium content (387.73mg/100g). Abara, (2011) [11] reported a potassium content of 440 mg/100g which was closer to the potassium content of the red cultivar (467.53mg/100g) obtained in this study, but higher than that of the green cultivar. Other literatures recorded a potassium content of 560mg/100g which was comparative to the values (387.73-667.53mg/100g) obtained from this study. *Dioscorea bulbifera* is a rich source of potassium and are of additional nutritional benefits for patients with blood pressure [22], however high K foods are omitted in the diets on people with renal failure [23]. The iron content of the green cultivar (137.53mg) was significantly ( $P < 0.05$ ) higher than that of the red and yellow cultivars (-37.54 and - 150.50mg/100g respectively). [11] [15].

Values from other literatures reported (2.92, 5.90, 3.90mg/100g respectively) which are lower than the values obtained from the green cultivar (137.53mg) in this study but higher than the values of red and yellow cultivar (-150.70 and -37.54mg/100g).[11][15]. The variations between cultivars may be due to experimental errors, and environmental conditions in which the tuber was grown. People in the tropics suffer from anemia because of the parasite infections which affect the absorption of Iron apart from the inadequacy of supply through food. Also, phytic acid forms insoluble compounds with Iron and hereby limits its absorption. The level of Iron found in *Dioscorea bulbifera* could be a major source of dietary iron despite the presence of phytic acid in it.

The red cultivar had highest sodium content (2403.00) which was significantly higher (P<0.05) than the green and yellow cultivar (575.25 and 87.25mg/100g) respectively. Abara, (2011) reported a sodium value of 550.00mg/100g which was similar to the value of the green cultivar (575.25mg/100g) but significantly (P<0.05) lower than that of the red cultivar and higher than that of the yellow cultivar (578.25mg/100g) [11]. Other literatures[15] , reported values of (17.8 and 63.38mg/100g respectively) which are lower than the values obtained in our study (87.25-2403mg/100g respectively) [15]. The value 2403mg/100g obtained in this study was higher than values reported and this could be attributed to the environmental factors upon which the plant was grown.

**Table 2: Mineral Composition Of *Dioscorea Bulbifera* Flour**

Cultivars	Manganese (mg/100g)	Potassium (mg/100g)	Iron (mg/100g)	Sodium (mg/100g)
Green	25.03 <sup>c</sup>	387.73 <sup>c</sup>	137.53 <sup>a</sup>	575.25 <sup>b</sup>
Yellow	75.02 <sup>b</sup>	667.53 <sup>a</sup>	1.10 <sup>c</sup>	87.25 <sup>c</sup>
Red	100.02 <sup>a</sup>	467.53 <sup>b</sup>	3.75 <sup>b</sup>	2403.00 <sup>a</sup>

Means of duplicates duplication

Means with the same superscripts within each column are not significantly different (p>0.05)

Means without the same superscripts within each column are significantly different (p<0.05)

### 3.3 Results of the Vitamin Composition of *Dioscorea bulbifera* Flour Samples

The result of the vitamin composition of three cultivars (Green, yellow and red) of raw untreated (control) samples of *Dioscorea bulbifera* is shown in TABLE 3.

The red cultivar had the highest level of vitamin A (700.88mg/100g) which is significantly higher (P<0.05) than the yellow and green cultivars (137.24 and 43.91mg/100g respectively). The green cultivar had the least vitamin A content. Vitamin A is required for night vision, and for a healthy skin. It assists the immune system and because of its anti-oxidant properties is great to protect against cancer formation and other diseases .The vitamin C content was highest in the yellow cultivar (0.26mg/100g) followed by the green cultivar (0.13mg/100g), while the red cultivar(0.04mg/100g) had the least vitamin C content. Okwu and Ndu (2006) reported a higher value of vitamin C (1.678mg/100g) [24].

Ascorbic acid activates the functions of all the cells. It is a powerful antioxidant. It favors the absorption of iron in the intestines, protects against infections and intervenes in the healing of wounds [25].

**TABLE 3: Values For The Vitamin Composition Of *Dioscorea Bulbifera* Flour**

CULTIVARS	Vitamins A (mg/100g)	Vitamins C (mg/100g)
Green	443.91 <sup>c</sup>	0.13 <sup>b</sup>
Yellow	137.24 <sup>b</sup>	0.26 <sup>a</sup>
Red	700.88 <sup>a</sup>	0.04 <sup>c</sup>

Means of duplicates duplication

Means with the same superscripts within each column are not significantly different (p>0.05)

Means without the same superscripts within each column are significantly different (p<0.05)

### 3.4 Anti-nutritional Composition of *Dioscorea bulbifera* Flour Samples

The result of the anti-nutritional content of the three cultivars (yellow, red, and green) of raw/untreated samples of *Dioscorea bulbifera* are shown TABLE 4.

The yellow cultivar had the highest level of phenol (1.64mg/100g) which was significantly (P<0.05) higher than the phenol content of the green and yellow cultivars. The green cultivar had the least phenol content. Okwu and Ndu, (2006) reported lower value of phenol (0.0024) while the value (1.04mg/100g) reported by Shantakumari et al., (2008) was similar to our values (1.105, 1.22 and 1.640mg) for the green, red and yellow cultivars respectively. A number of polyphenolic compounds are present in plants, which contribute towards the defense mechanism of plant [15]. In some species of yam tubers, browning reactions occurs when the tissues are injured and exposed to air. The presence of phenol indicates that *Dioscorea* species could act as anti-inflammatory, anti-clothing, antioxidant immune enhancers and modulators. [26] [27].

The saponin content of the three cultivars varied from 5.463-14.034%. There was significant ( $P<0.05$ ) difference in the saponin content of the cultivars. The green cultivar had the highest level of saponin (14.03%) which was significantly higher than that of the red and yellow cultivars. Some general properties of saponins include formation of foams in aqueous solution, hemolytic activity and cholesterol binding properties and bitterness [28]. Saponins anti-microbial activities make them good for treating fungal and yeast infections [24]. The oxalate content of the three cultivars was 12.606mg/100g and 10.895mg/100g for the green, red and yellow cultivars respectively. The level of oxalate in the green cultivar was significantly ( $P<0.05$ ) higher than the oxalate level in the red and yellow cultivar.

Comparatively, the oxalate content of *Dioscorea bulbifera* in the three cultivars were lower than the oxalate in other species of yam such as *D. oppositifolia* (3mg/100g), *D. Pentaphylla* (33mg/100g) *D. tomentosa* (30mg/100g) but similar to the oxalate content of *D. wallichii* [15]. Shanthakumari et al., 2008 reported a higher of level in *D. bulbifera*. Oxalic acid and oxalate occur naturally in plants but they have little or no useful effect on human health as high levels in diets lead to irritation of the tissues, the digestion system, particularly the stomach and kidney [29] [4].

The tannin content of the three cultivars ranged from 0.186-0.227mg/100g. There was significantly difference in the tannin content of the cultivars. The green cultivar (0.22mg/100g) had the highest tannin content while the yellow cultivar (0.18mg/100g) had the least tannin content. The bitter principles of *D bulbifera* may be due to the presence of tannins in them [24]. The small quantities of tannin available in the tubers act as a repellants against rot in yams.

**TABLE 4: Anti-nutritional Composition of *Dioscorea bulbifera* Flour**

Cultivars	Phenol (mg/100g)	Saponin (mg/100g)	Oxalate (mg/100g)	Tannin (mg/100g)
Green	1.10 <sup>c</sup>	14.03 <sup>a</sup>	12.60 <sup>a</sup>	0.22 <sup>a</sup>
Red	1.22 <sup>a</sup>	5.46 <sup>c</sup>	9.00 <sup>c</sup>	0.19 <sup>b</sup>
Yellow	1.64 <sup>a</sup>	8.49 <sup>b</sup>	10.89 <sup>b</sup>	0.18 <sup>c</sup>

Means of duplicate determination

Means with the same superscripts within each column are not significantly different ( $p>0.05$ )

Means without the same superscripts within each column are significantly different ( $p<0.05$ )

#### IV. Conclusion

*Dioscorea bulbifera* which have been regarded as a non-edible yam by people as a result of belief, culture or chemical constitutes has been observed from this study to be edible. These yam contains not only the essential; nutrients like protein, fat, crude fiber they also contain photochemical which help fight against most disease of man, minerals and vitamins. They also have low moisture content which makes them store for a long time. *Dioscorea bulbifera* is rich in sodium, saponin and oxalate therefore to obtain the maximum nutritional composition of this crop, the correct processing method must be employed, also the use of the specific cultivar for a particular use should be considered since the nutritional composition of the three cultivars vary in several ways.

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