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# Evaluation of Chemical Compositions of Commonly Used Wrapping Leaves for Cooking in South-South Nigeria

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***Abstract:*** *Proximate, phytochemical and anti-nutrients compositions of fresh and blanched leaves of sweet potato, ikpan and cocoyam were evaluated. The moisture content of fresh ikpan, and cocoyam leaves was significantly ($p<0.05$) higher than their blanched samples while fresh samples of sweet potato had lower values. There was a significant ($p<0.05$) increase in the crude protein contents of blanched ikpan and sweet potato leaves while a reduction was observed in blanched cocoyam leaf. The crude lipid content of the fresh leaves had significantly higher values compared to the blanched leaves. It was also observed that there was a significant ($p<0.05$) increase in the ash content whereas there was a reduction in the crude fibre content of the blanched leaves. Carbohydrate contents of blanched leaves of ikpan and cocoyam showed significant increase compared to blanched sweet potato leaf. Significant ($p<0.05$) reduction in phytochemical composition after blanching was observed in alkaloid, polyphenol, saponin and tannin levels in all blanched leaves with no detection of polyphenol content in the blanched cocoyam leaf. The selected anti-nutritional composition of the leaf samples showed significant ($p<0.05$) reduction in oxalate and phytate levels of all blanched leaves with no detection of hydrogen cyanide.*

***Keywords****: leaves, moisture content, blanched, reduction, fresh*

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## I. Introduction

Vegetables form an important part of human diet that may be eaten raw, cooked alone or with other preparations. The importance and awareness of nutrient in public health issues have resulted in the increase demand of knowledge of the nutrients in vegetables[1]. Green leafy vegetables are important food item in many Nigerian home[2]. Awareness of the significance of vegetable consumption plays an important role in maintaining good health, and in reducing the risk of illness. Vegetable is a source of carotene, ascorbic acid, riboflavin, folic acid (vitamin $B_9$), and minerals like calcium, phosphorus, potassium and iron[3], and it also contains some phytochemical compounds which serves as valuable antioxidant and protectant to the body system of man when consumed. For years, there has been increasing demand for fresh vegetables mainly because of their convenience as ready-to-eat products as well as their health benefits associated with their consumption. Vegetables that are common in Nigeria markets can be categorized into two main categories i.e. the common or utilized and the under-utilized or miscellaneous categories. The common types include water leaf, bitter leaf, pumpkin leaf, jute leaf, spinach, etc. The under-utilized category include sweet potatoes leaf, and cocoyam leaf though Akwa Ibom people have tried utilizing it in wrapping cocoyam porridge locally known as *ekpang*.

Cocoyam (*Colocasia esculenta* L.), a member of the *Araceae* family is an ancient crop grown through-out the humid tropics for its edible corns, cormels and leaves, as well as for other traditional uses. They are mostly tropical and subtropical. Its corns are important source of starch. The corns can be cut up and boiled in curries or fried to make crispy chips. The leaf stalk and matured leaves are also eaten as vegetables. Sweet potato *(Ipomoea batatas*) has played an important role as energy and a phytochemical source in human nutrition. It continues to be of remarkable economic value as the sixth most plentiful food crop in the world[4]. This tuberous root is a high-quality source of carbohydrates, dietary fibre, vitamin A (as β-carotene), vitamin B, vitamin C, manganese, copper, potassium, and iron. *Ikpan* (*Mallotus* spp) leaf is a compact deciduous shrub or small tree with long arching branches. It is commonly called *mfang ikpan* in Ibibio and used as colour enhancer in the production of *ikpan* cake[5]. The unavailability of accurately documented information on the nutritive potential of these leaves led to low tapping of the high source of nutrients. Though these leaves are underutilized, they are used mainly for important dishes in South-South Nigeria such as *Ekpang nkukwo* and *ikpan* (local snack), therefore, the objective of this study was to determine the nutritional, phytochemical and anti-nutritional compositions of fresh (raw) and blanched leaves of sweet potato, *ikpan* and cocoyam.

## II. Materials and Methods

### 2.1 Collection of Raw Materials

Sweet potato, *ikpan* and cocoyam leaves were obtained from a farm at Ibiono Local Government Area, and was identified by a Taxonomist in the Department of Botany University of Uyo, Akwa Ibom State and taken to Food Science and Technology processing laboratory, University of Uyo for onward processing and analyses.

### 2.2 Preparation of the Samples

The harvested leaves were grouped into two. The first group was destalked, washed and dried in the conventional air oven (model pp, 22 US, Genlab, England) at 55 $^{o}$C. The second part was destalked, washed and processed by dipping in hot water (blanching) for 15 min. It was drained and ovendried at 55 $^{o}$C. The dried leaf samples were ground into a fine powder, sieved using a mesh size no. 60 (250 μm), packaged in a well labeled air-tight containers and stored at 4 $^{o}$C for subsequent use.

### 2.3 Methods of Analysis

#### 2.3.1 Determination of proximate composition

Moisture, crude protein, crude lipid, crude fibre and ash contents of the samples were determined using AOAC[6] method. The carbohydrate content of the sample was obtained by difference i.e. % Carbohydrate = 100 - (% Moisture + % Crude lipid + % Crude protein + % Crude fibre + % Ash). Estimations of caloric value of the samples were determined through Atwater factor by multiplying the crude protein, lipid, and carbohydrate by 4, 9 and 4, respectively and taking the sum of the products.

#### 2.3.2 Determination of phytochemical

Alkaloid and tannin contents were determined using the method described by Harbourne[7]. Total phenol content was determined using the modified method of Koncic *et al.*[8] with the Folin-ciocalteu reagent. Saponin was determined according to the method described by Obadoni and Ochuko[9].

#### 2.3.3 Determination of anti-nutrients

Oxalate content was determined using the method of Day and Underwood[10]. Phytate content of the samples was determined according to method of Maga[11]. Alkaline titration method of AOAC[6] was used for the determination of hydrogen cyanide (HCN).

### 2.4 Statistical Analysis:

Triplicate data were subjected to One Way Analysis of Variance (ANOVA) using Statistical Package for Social Science (SPSS, version 20). The significance differences between the mean in each parameter was determined using Duncan's New Multiple Range Test at $p<0.05$.

## III. Results And Discussion

### 3.1 Proximate Composition of Fresh and Blanched Leafy Vegetables

Proximate composition of fresh and processed leaves (sweet potato, *ikpan* and cocoyam) is presented in Table 1. The result showed that the samples were significantly ($p<0.05$) different in all the parameters analysed. The moisture content ranged from 76.20- 83.40% with *ikpan* leaf having the highest for fresh and lowest value for blanched samples. The availability of moisture in vegetables determines its freshness. The moisture content of fresh sweet potato was slightly lower (80.17%) than the blanched sample (82.40%). The higher values obtained in this study are similar to the results obtained for other leafy vegetables as reported by Oduse *et al.*[12]; Odedeji *et al.*[13] and John and Opeyemi[14]. Crude protein content ranged from 3.30-8.10% with blanched sweet potato leaf having the highest value. The crude protein content of the fresh samples falls within the range of values reported by Taiwo *et al.*[15] and Odedeji *et al.*[13]. The values increased after blanching in sweet potato and *ikpan* leaves. The increase in protein after blanching might be due to the elimination of tannin which is an anti-nutritional factor by the heat of blanching; this is found to precipitate the fresh leaves sample making it unavailable for utilization[16]. Crude lipid content of fresh and blanched leaves ranged from 1.15-3.13%. This result supports the claim of John and Opeyemi[14]. The ash content ranged from 1.90-3.20%. It significantly increased after blanching of the leaf samples. Ash content is an index of mineral constituents. High ash content represents higher mineral content. The ash contained obtained in this study agrees with the findings of Odedeji *et al.*[13] but lower that the values (9.0 and 4.0%) reported by Azubuike *et al.*[17] for fresh and boiled cocoyam leaves, respectively. The crude fibre content of the fresh and blanched sweet potato, *ikpan* and cocoyam leaves were found to be 3.50 and 2.60%, 3.10 and 2.10%, 4.20 and 3.40%, respectively. The crude fibre content of the blanched leaves were lower compared with the fresh, this supports the claims of John and Opeyemi[14].The decrease noticed in the crude fibre content after blanching might be due to effect of thermal processing break down the fibre components in to smaller and soluble forms[18]. These values agrees with the findings (4.00-

4.59%) of Temesgen *et al.*[19] for cocoyam leaf but lower than 5.20% reported for sweet potato leaves by Oboh[16]. The crude fibre content of these edible leaves both raw and blanched could prevent intestinal irritation; improve digestibility and overall increase in nutrient utilization. Carbohydrate content ranged from 3.11-10.35% and caloric value ranged from 59.15-82.20 kcal/100g. Blanching significantly ($p<0.05$) reduce the carbohydrate content of sweet potato whereas that of *ikpan* and cocoyam leaves increased significantly after blanching. The increase might be due to the destruction of the anti-nutritional factor binding this nutrient in the raw fresh sample. These values fall within the range of values reported by Odedeji *et al.*[13].

**Table 1**: Proximate composition and caloric value of fresh and blanched leafy vegetables

| | Sweet potato leaf | | *Ikpan* leaf | | Cocoyam leaf | |
|---|---|---|---|---|---|---|
| Parameters | Fresh | Blanched | Fresh | Blanched | Fresh | Blanched |
| Moisture (%) | $80.17^{d}$±0.01 | $82.40^{b}$±0.03 | $83.40^{a}$±0.01 | $76.20^{f}$±0.01 | $80.40^{c}$±0.00 | $79.20^{e}$±0.02 |
| Crude protein (%) | $5.80^{c}$± 0.01 | $8.10^{a}$± 0.01 | $4.60^{d}$± 0.00 | $7.10^{b}$ ±0.01 | $4.60^{d}$± 0.01 | $3.30^{e}$±0.02 |
| Crude lipid (%) | $2.92^{b}$ ± 0.00 | $1.59^{e}$± 0.01 | $2.57^{c}$± 0.00 | $1.64^{d}$± 0.01 | $3.13^{a}$± 0.02 | $1.15^{f}$±0.02 |
| Ash (%) | $1.90^{d}$± 0.02 | $2.20^{c}$± 0.00 | $1.90^{d}$± 0.02 | $3.20^{a}$± 0.01 | $2.20^{c}$ ± 0.00 | $2.60^{b}$±0.03 |
| Crude fibre (%) | $3.50^{b}$± 0.03 | $2.60^{e}$ ± 0.02 | $3.10^{d}$± 0.01 | $2.10^{f}$± 0.02 | $4.20^{a}$± 0.02 | $3.40^{c}$±0.03 |
| Carbohydrate (%) | $5.71^{c}$± 0.07 | $3.11^{f}$± 0.05 | $4.43^{e}$ ±0.02 | $9.76^{b}$±0.04 | $5.47^{d}$±0.04 | $10.35^{a}$±0.09 |
| Caloric value (kcal/100g) | $72.32^{b}$±0.24 | $59.15^{e}$±0.25 | $59.25^{e}$±0.08 | $82.20^{a}$±0.04 | $68.33^{c}$±0.15 | $64.95^{d}$±0.15 |

Values are means ± S.D of triplicate determination. Means along the rows with different superscripts are significantly different at $p<0.05$.

### 3.2 Phytochemical Composition of Fresh and Blanched Leafy Vegetables

The phytochemical composition of fresh and blanched leaves is shown in Table 2. The alkaloid content ranged from 1.41-3.55 mg/100g with fresh sweet potato leaf and blanched *ikpan* leaf having the highest and lowest values, respectively. Decrease in alkaloid content indicates that blanching reduced the level of alkaloid in the fresh leaves. Ekeleme *et al.*[20] reported that alkaloids are effective for its detoxifying and antihypertensive properties. Alkaloids have been implicated in the inhibition activities of many bacterial species[21]. The total polyphenol content ranged from 2.57-13.58 mg/100g with no detection in blanched cocoyam. The saponin content ranged from 0.02-1.05 mg/100g where blanched leaf samples of *ikpan* and cocoyam where not significantly different ($p<0.05$). Saponin content of the fresh samples was higher than the blanched which means blanching would have reduced it to a minimal level the body can accommodate. Saponins (in excess) causes hypocholesterolaemia because it binds cholesterol making it unavailable for absorption[22]. The tannin content ranged from 0.01 mg/100g to 0.88 mg/100g. Tannins are phenolic compounds that react with proteins. They are astringent and adversely affect feed intake. Tannins bring about their anti-nutritional influence largely by precipitation or binding dietary protein and digestive enzymes to form complex which are not readily digestible[13]. Tannins are known to inhabit the activities of some enzymes like amylase and lipase resulting from the formation of complexes with protein. Blanching has been shown to reduce the tannin content of the leaf samples. The range of values obtained for tannin content in this study was lower compared with the work of Oboh[16] and John and Opeyemi[14].

**Table 2**: Phytochemical composition (mg/100g) of fresh and blanched leafy vegetables

| | Sweet potato leaf | | *Ikpan* leaf | | Cocoyam leaf | |
|---|---|---|---|---|---|---|
| Parameters | Fresh | Blanched | Fresh | Blanched | Fresh | Blanched |
| Alkaloid | $3.55^{a}$ ± 0.00 | $2.27^{d}$ ± 0.03 | $2.69^{c}$ ± 0.03 | $1.41^{f}$ ± 0.02 | $2.93^{b}$ ± 0.02 | $1.58^{e}$ ± 0.00 |
| Polyphenol | $3.39^{c}$ ± 0.00 | $2.81^{d}$ ± 0.03 | $13.58^{a}$ ± 0.01 | $2.57^{e}$ ± 0.02 | $6.62^{b}$ ± 0.02 | ND |
| Saponin | $0.18^{b}$ ± 0.02 | $0.05^{c}$ ± 0.02 | $1.05^{a}$ ± 0.01 | $0.03^{cd}$ ± 0.00 | $0.02^{d}$ ± 0.00 | $0.04^{cd}$ ± 0.01 |
| Tannin | $0.72^{b}$ ± 0.02 | $0.28^{c}$ ± 0.00 | $0.88^{a}$ ± 0.02 | $0.04^{e}$ ± 0.00 | $0.13^{d}$ ± 0.03 | $0.01^{f}$ ± 0.00 |

Values are means ± S.D of triplicate determination. Means along the rows with different superscripts are significantly different at <0.05. ND = No Detection

### 3.3 Anti-nutrient Content of Fresh and Blanched Leafy Vegetables

The anti-nutrient content of fresh and blanched leaves is shown in Table 3. It was observed that the processing method employed (blanching) had a significant effect ($p<0.05$) on all the anti-nutritional factors. Oxalate content of the fresh samples was within the range of 9.56-39.05 mg/100g while blanched samples was within the range of 5.54-32.74 mg/100g. There was a significant reduction in oxalate content of the blanched samples as also reported by Morrison and Savage[23]. Oxalate is known to interfere with calcium absorption by forming insoluble salt of calcium. This insoluble salt of calcium is capable of passing through the excretory system and interrupts with the efficient working of the kidney, otherwise causes a disease called kidney stone[24]. Phytate content ranged from 0.37-2.78 mg/100g. The results also showed that there was no detection of hydrogen cyanide in the leaf samples. The values were lower compared with the work of Odedeji[14]. Blanching

was able to reduce the phytate content of the fresh samples drastically as reported by Morrison and Savage[23]. Phytate content of food products has been known to lower the bioavailability of minerals and inhibit the activity of several enzymes[25]. Hydrogen cyanide was not detected when tested.

**Table 3**: Anti-nutrient content (mg/100g) of fresh and blanched leafy vegetables

| | Sweet potato leaf | | *Ikpan* leaf | | Cocoyam leaf | |
|---|---|---|---|---|---|---|
| Parameters | Fresh | Blanched | Fresh | Blanched | Fresh | Blanched |
| Oxalate | $33.31^{a}$± 0.01 | $32.74^{c}$ ± 0.02 | $39.05^{b}$ ± 0.02 | $17.29^{d}$ ± 0.02 | $9.56^{e}$±0.01 | $5.54^{f}$ ±0.00 |
| Phytate | $1.55^{c}$ ± 0.00 | $0.37^{f}$ ± 0.02 | $2.78^{a}$ ± 0.02 | $1.02^{d}$ ± 0.02 | $2.48^{b}$ ± 0.01 | $1.02^{e}$± 0.00 |
| HCN | ND | ND | ND | ND | ND | ND |

Values are means ± S.D of triplicate determination. Means along the rows with different superscripts are significantly different at $p<0.05$. ND = No Detection.

## IV. Conclusion

The study has shown that fresh sweet potato, *ikpan* and cocoyam leaves are highly rich in nutrients and therefore good for human consumption for the maintenance of health and vitality. The level of these nutrients falls within those of other edible leaves. Blanching had a positive effect by increasing crude protein and ash contents. Fresh leaves had appreciable level of phytochemicals while significant reduction was observed during hot water blanching. Processing also lowering the level of anti-nutritional factors in all the three leaves investigated.

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