



## **Comparative Study of Chemical Composition of Three Different Eggplant Fruit Species**

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### **Authors' contributions**

*This work was carried out in collaboration among all authors. Authors AB, KW, NC and EA designed the study. Authors AB, NC, EA and EI performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors KW, EI, OC and ON managed the analyses of the study. Authors NW, EA, EI, OC and ON managed the literature searches. All authors read and approved the final manuscript.*

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### **ABSTRACT**

Chemical composition of three different eggplant fruit species was studied using standard methods. *Solanum aethiopicum*, *Solanum melongena* and *Solanum macrocarpon* fruit species were used as samples. Results obtained showed high moisture, phytate and oxalate contents in the investigated fruit species. Vitamin concentrations of the investigated fruits ranged from high to low. One or two of the investigated fruits possessed a higher amount of the chemical compounds than others. This study has shown the comparative study of the chemical composition of three different eggplant fruit species.

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## 1. INTRODUCTION

The importance of plants and the roles they play in nutrition especially in humans cannot be overstated [1-10]. Studies have shown that products of plants contain chemicals that offer protection to the body [11-19]. In Africa, some plant products are employed as a laxative and in treating many disease conditions. They also serve as medicines and are used in traditional or complementary medicine industry [10,12,19-27].

Different researchers have identified the chemical compounds responsible for the pharmacological action of different parts of plants [28-30]. It is a known fact that most of these compounds that confer protective and medicinal property to them. These compounds possess the characteristic of being biologically active [31-34]. Among such compounds are phytochemicals, vitamins, minerals, amino acids, etc [35-36]. The roles these compounds play in both plants and animals have long been noted [31-34]. Due to the roles of these compounds, there is a need ascertain their presence in plants that come in varieties.

Eggplant is one of such plants that come in varieties with fruits [16,37-38]. Both the leaves and fruits of eggplant are edible. Aside from the leaves and fruits, all parts of eggplant are employed in traditional medicine against one illness or another [26,32]. Most varieties of the fruits that come from a different variety of eggplants are edible. The edible variety of these fruits especially in African continent covers a large group, whereas the major edible species of the fruits are *Solanum aethiopicum*, *Solanum melongena*, and *Solanum macrocarpon*. In Nigeria, the fruits are called "Añara" or "Afufa" or "Mkpuruofe" in Igbo; "Sokoyokoto or "Igba" in Yoruba; and "Gauta" in Hausa. The consumption of these *Solanum* fruits is spread to all parts of the country. The fruits are used during the ceremony, as medicines by herbalists [30,35-36], and in place of kola nuts at homes [26, 32,39-40]. Due to the importance of this variety of *Solanum* fruits within Nigeria, there is need to investigate their active compounds as to advise the people properly on their consumption.

The present study, therefore, compared some chemical composition of *Solanum aethiopicum*,

*Solanum melongena* and *Solanum macrocarpon* fruits.

## 2. MATERIALS AND METHODS

**Sample collection and preparation:** The *Solanum* specie fruit samples used in the present study were purchased from a farm within Owerri Municipal, Imo State, Nigeria and were properly identified by Dr. F. N. Mbagwu of Plant Science and Biotechnology Department, Imo State University, Owerri, Nigeria. Fresh samples of the identified fruits were ground using a simple electric blender. The ground samples were used for analysis.

### 2.1 Chemical Compound Analysis

**Proximate content:** Moisture, ash, lipid and fibre contents were determined according to the procedures of [41]. Nitrogen was determined using kjeldahl method and crude protein value was determined by multiplying the obtained nitrogen value by a factor of 6.25 [41]. The carbohydrate content was obtained by the difference between 100 and sum total of other proximate content of the present study while energy value was obtained using the Atwater factor of 4:9:4 of carbohydrate, lipid and protein respectively by following the procedures of Onyeike et al. [42].

**Anti-nutrients:** Saponins were determined as described by [43], alkaloids of this study were done using the method of [44], tannins were determined using the method of [45], phytate and oxalate contents were done with the methods of [42]; and [46] respectively.

**Vitamins:** The vitamins A, B complex, C and E were screened in the present study with the methods of [47].

## 3. RESULTS AND DISCUSSION

Proximate composition result of the studied fruits showed the highest moisture content (90.30 g/100 g) in *S. macrocarpon*. Moisture content is related to shelf life and susceptibility of the food material to microbial attack [47]. The observed values of moisture in this study followed the order of *S. macrocarpon* > *S. aethiopicum* > *S. melongena*. In general, the moisture contents of the studied fruit specie are high and could mean

low shelf life for the fruits. The observed moisture content values of the investigated fruit species in the present study were higher than the values reported by Agoreyo et al. [48] on two varieties of *Solanum melongena*. The ash content of food materials is related to mineral contents [1,47]. The ash contents of the studied fruit species were low and followed the order *S. melongena* > *S. aethiopicum* > *S. macrocarpon*. Relatively, the high value of ash in *S. melongena* specie against other fruit species in the present study could mean more minerals in the fruit specie than others. The studied fruit species have protein range 1.73-4.40 g/100 g with *S. melongena* specie producing the highest protein when compared to other species. It could be that it can supply this protein to the biological system on consumption. Studies have shown that fibre in foods has numerous advantages such as making stools softer and bulkier; lowering cholesterol levels, reduction of risk of colon cancers, etc [49]. *S. aethiopicum* may be best adapted to perform these functions since it produced the highest crude fibre value of 2.20 g/100 g when compared to other studied fruit species. The observed crude fibre content of *S. aethiopicum* in this study is in line with the earlier report by Shalom et al. [38] on the fruit. *S. macrocarpon* had the least crude fibre content in the present study. The studied fruit species could be classified as poor in carbohydrate contents and this could as well be the cause of the poor energy values of the fruits as observed in the present study. The observed low carbohydrate and energy values of the studied fruit species could be that they are poor in energy-giving compounds.

Anti-nutrients are mostly planted chemicals that protect them. When ingested in animals (humans inclusive), they could be beneficial or deleterious depending on their levels [2-3,6-10,14-31,50]. Observed saponin levels in the present study followed the order *S. aethiopicum* > *S. macrocarpon* > *S. Melongena* (Table 1). Saponins are non-toxic but can generate adverse physiological responses in animals that consume them. Akindahunsi and Salawu [51] noted that saponins exhibit cytotoxic effect and growth inhibition against a variety of cells, making them have anti-inflammatory and anticancer properties. *S. aethiopicum* may be best suited to produce these effects in the system when consumed due to the observed level of saponins in the fruit when compared to other species considered in this study. Alkaloids are ranked as

the most efficient therapeutically significant plant compound [24,52]. They also exhibit marked physiological activity when administered to animals. Some alkaloid compounds have been reported as convulsant alkaloids and cause central nervous system paralysis in animals [53]. Care should, therefore, be taken in the consumption of *S. aethiopicum* fruit, which produced the highest alkaloid content in the present study. Tannins are noted for their astringency and bitterness [3,7,9,14,19,23,25-27]. The bitter taste of *S. melongena* fruit specie could be attributed to its high value of tannic compound as observed in the present study. *S. melongena* fruit specie had the highest phytate and oxalate contents in the present study. Phytates chelate important elements and bind to proteins hence reducing their absorption in the body [47]. Oxalates remove important minerals such as calcium, etc and precipitate them as kidney stone [47]. The presence of saponins, alkaloids, tannins, phytates and oxalates as observed in this study agree with the earlier work of Shalom et al. [38] on proximate and phytochemical analysis of *Solanum aethiopicum* L and *Solanum macrocarpon* L. fruit.

Table 3 reveals the vitamin composition of the investigated fruit species. The investigated fruit species showed low concentrations of vitamin A, B<sub>2</sub> and E. *S. aethiopicum* and *S. melongena* fruit species had moderate concentrations of vitamin B<sub>1</sub>; *S. aethiopicum* and *S. macrocarpon* were moderate in terms of vitamin B<sub>3</sub>; *S. melongena* and *S. macrocarpon* showed moderate concentrations of vitamin B<sub>6</sub>; while vitamin C was highest in *S. aethiopicum* fruit specie. In a related study, Shalom et al. [38] reported high and moderate concentrations of vitamin C in *Solanum aethiopicum* and *Solanum macrocarpon* respectively. The observed vitamins become important when their functions are considered in the system [1,24,54-57]. From the vitamin result of the present study (Table 3), and sequel to the functions of the observed vitamins, *S. aethiopicum* and *S. melongena* fruit species could be against thiamine deficiency; *S. aethiopicum* and *S. macrocarpon* against pellagra disease, *S. melongena* and *S. macrocarpon* may be against deformation of red cells; whereas *S. aethiopicum* specie could be for anti-scurvy following the consumption of the studied fruit species.

**Table 1. Proximate composition of *S. aethiopicum*, *S. melongena* and *S. macrocarpon* fruits**

Proximate content	<i>S. aethiopicum</i>	<i>S. melongena</i>	<i>S. macrocarpon</i>
Moisture content (g/100 g)	86.57±1.01	81.43±0.85	90.30±0.41
Ash(g/100 g)	1.08±0.02	1.94±0.05	0.64±0.11
Protein ( g/100 g)	2.59±0.13	4.40±0.18	1.73±0.09
Crude fibre (g/100 g)	2.20±0.70	1.80±0.12	1.31±0.43
lipid(g/100 g)	0.92±0.01	1.05±0.05	0.70±0.03
Carbohydrate (g/100 g)	6.64±1.06	9.38±0.90	5.32±0.82
Energy value (Kcal/100 g)	45.20±0.17	64.66±1.02	64.88±0.30

Results are means and standard deviations of quadruplicate determinations

**Table 2. Anti-nutrient composition of *S. aethiopicum*, *S. melongena* and *S. macrocarpon* fruits**

Anti-nutrient (mg/100 g)	<i>S. aethiopicum</i>	<i>S. melongena</i>	<i>S. macrocarpon</i>
Saponins	11.69±0.32	5.34±0.13	9.26±0.29
Alkaloids	4.12±0.10	1.16±0.09	1.09±0.04
Tannins	1.07±0.03	9.05±0.11	1.14±0.07
Phytates	17.01±1.04	28.19±1.15	16.43±1.20
Oxalates	38.37±0.12	41.27±0.10	22.01±0.11

Results are means and standard deviations of quadruplicate determinations

**Table 3. Vitamin composition of *S. aethiopicum*, *S. melongena* and *S. macrocarpon* fruits**

Vitamin	<i>S. aethiopicum</i>	<i>S. melongena</i>	<i>S. macrocarpon</i>
Vitamin A	+	+	+
Vitamin B <sub>1</sub>	++	++	+
Vitamin B <sub>2</sub>	+	+	+
Vitamin B <sub>3</sub>	++	+	++
Vitamin B <sub>6</sub>	+	++	++
Vitamin C	+++	++	++
Vitamin E	+	+	+

+++ (high concentration); ++ (moderate concentration); +(low concentration)

#### 4. CONCLUSION

The high phytate and oxalate contents of the investigated fruit species are alarming if attention is drawn to [58]. This observation calls for a further study on the fruit species. The present study has shown the comparative study of chemical compounds present in three different species of the fruit of an eggplant.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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