



**COMPARATIVE
ASSESSMENT OF THE
PHYTOCHEMICALS AND
MINERALS OF SOLANUM**

**GILO AND SOLANUM MELONGENA
FRUITS**

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Abstract

Eggplant fruits (*solanum gilo* and *solanum melongena*) are two species that are commonly grown in the Northern Nigeria, Sokoto State. This work aimed at comparing some of the Phytochemicals and some of the minerals composition of fruits from the two species of the Eggplant using standard analytical methods. The phytochemicals analysis showed *solanum gilo* and *solanum melongena* contained the same value for both saponins, cardiac glycosides, oxalate which were 1.00 ± 0.20 %, 1.20 ± 0.12 %, and 0.07 ± 0.00 % respectively, 1.00 ± 0.20 % and 0.73 ± 0.12 % alkaloid, 2.03 ± 0.40 % and 0.28 ± 0.00 % flavonoid, 32.28 ± 0.22 and 64.43 ± 0.06 % tannins, 77.83 ± 1.15 % and 21.10 ± 0.36 % steroid. The results from the two fruits showed that

saponin, alkaloid, cardiac glycoside, and oxalate were not significantly different at $P < 0.05$, while flavonoid, tannin, steroid were significantly

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different. The mineral contents of *solanum gilo* and *solanum melongena* indicated 0.68 ± 0.04 mg/kg and 0.37 ± 0.02 mg/kg phosphorous, 8.73 ± 0.07 mg/kg and 4.77 ± 0.10 mg/kg calcium, 19.33 ± 0.12 mg/kg and 13.83 ± 0.15 mg/kg magnesium, 37.66 ± 0.88 mg/kg and 46.33 ± 0.67 mg/kg sodium, 45.33 ± 0.67 mg/kg and 61.33 ± 1.20

mg/kg potassium, 1.92 ± 0.01 mg/kg and 1.13 ± 0.01 mg/kg iron, 0.43 ± 0.01 mg/kg and 0.27 ± 0.01 mg/kg zinc, 0.39 ± 0.00 mg/kg and 0.34 ± 0.01 mg/kg manganese, 0.19 ± 0.01 mg/kg and 0.21 ± 0.12 mg/kg copper. The results from the two fruits were significantly different at $P < 0.05$. These mineral elements and phytochemicals are of nutritional and therapeutic importance; their presence in both fruits indicated the beneficial effects of the Eggplant. *Solanum gilo* contained higher levels of the beneficial agents than *Solanum melongena*.

INTRODUCTION

Fruits and vegetables are sources of bioactive phytochemicals and mineral elements which are essential components of human daily diet. *Solanum* (garden eggs/eggplants) are classified as follows

- Kingdom: plantae
- Order: Solanales
- Family: Solanaceae
- Genus: Solanum
- Species: Gilo

Solanum is a widespread plant genus with over 1,000 species worldwide and at least 100 indigenous species in Africa, and also about 25 different species in Nigeria. However those commonly found are *S.gilo*, *S.melongena*, *S.macrocarpon*, *S.anguivi* and *S.incanum* (Oyeyemi et' al., 2015)

MATERIALS/METHODS

Fruits of *Solanum gilo* and *Solanum melongena* were collected from three farms in More village, Kware L.G.A. of Sokoto State, North-West, Nigeria (Latitude $13^{\circ}13'5''$ N and Longitude $5^{\circ}16'2''$ E by National population census 2006) by Random Method of Sampling. Thirty (30) Fruits of each of the plants were collected and identified at the Department of Plant Science and Biotechnology, Faculty of Life Sciences, Kebbi State University of Science and Technology Aliero (KSUSTA). Voucher number of *Solanum Gilo* is

KSUSTA/PSB/H/VOUCHER NO: 524B and Voucher number of *Solanum Melongena* is KSUSTA/PSB/H/VOUCHER NO: 524A. All reagents and chemicals used were of analytical grade.

Sample Preparation and Processing

The Samples were sundried and pulverized to powder. The pulverized fruits were used for the phytochemicals, and minerals analysis. Standard analytical methods were used.

Results and Discussion

Phytochemical Analysis

Table 1A gives the qualitative phytochemical screening of *solanum gilo* and *solanum melongena*. The presence of saponin, Alkaloid, Flavoniod, Cardiac Glycoside and Oxalate are slightly present in both the *solanum gilo* and *solanum melongena*. The presence of tannins is moderate in the *solanum gilo* and highly presence in the *solanum melongena*, steriods is highly presence in the *solanum gilo* and moderately presence in the *solanum melongena*.

Table 1A: Qualitative Phytochemical composition of *Solanum Gilo* and *Solanum Melongena* fruits

S/n	Parameter	<i>Solanum Gilo</i>	<i>Solanum Melongena</i>
1.	Saponin	+	+
2.	Alkaloid	+	+
3.	Flavonoid	+	+
4.	Cardiac Glycoside	+	+
5.	Oxalate	+	+
6.	Tannins	++	+++
7.	Steroid	+++	++

+++ (Highly present), ++ (Moderately Present), + (Slightly Present).

The result of quantitative phytochemical analysis is shown in table 1B the concentration of

Saponin, Alkaloid, Cardiac Glycoside and Oxalate are not statistically different at $P < 0.05$.

However, the Flavonoid, tannins and steriods are statistically different at $P < 0.05$.

Table 1B: Quantitative Phytochemical Analysis of *Solanum Gilo* and *Solanum Melongena* fruits

S/n	Parameter	<i>Solanum Gilo</i> (%)	<i>Solanum Melongena</i> (%)	
1.	Saponin	1.00 ± 0.20	$1.00 \pm$	0.20
2.	Alkaloid	1.00 ± 0.20	$0.73 \pm$	0.12
3.	Flavonoid	2.03 ± 0.40^a	$0.28 \pm$	0.00^b
4.	Cardiac Glycoside	1.20 ± 0.12	$1.20 \pm$	0.00
5.	Oxalate	0.07 ± 0.00	$0.07 \pm$	0.00
6.	Tannins	32.28 ± 0.22^a	64.43	$\pm 0.06^b$
7.	Steroid	77.83 ± 1.15^a	21.10 ± 0.36^b	

Values are mean \pm SD for three replications and values with different superscript are statistically different at $P < 0.05$.

The saponins values obtained is the same, that is $1.00 \pm 0.20\%$ for *solanum gilo* and *solanum Melongena* respectively. The results fall in line with the $1.29 \pm 0.11\%$ and $1.08 \pm 0.4\%$ reported for *solanum anguivi* by Oyeyemi et al., (2015) and Ndife et al., (2019) respectively. The results of this study was very low when compared with the $19.9 \pm 0.67\%$ and $5.34 \pm 0.31\%$ reported for *solanum incanum* by Auta et al., (2011) and Agoreyo et al., (2012). Saponins are thermal sensitive (Ndife et al., 2019), also high concentration of Saponins in the body can reduce uptake of certain nutrients including glucose and cholesterol leading to hypercholesterolemia effect (Udeme et al., 2013). Saponins found in fruits are important dietary supplements; nutraceuticals and useful in preparation of traditional medicine (Shalom et al., 2011).

Alkaloids contents showed $1.00 \pm 0.20\%$ and $0.73 \pm 0.12\%$ for *solanum gilo* and *solanum melongena* respectively, the value for *solnum gilo* compared well with the value for *solanum melongena*. The results compared well with the earlier report of $1.16 \pm 0.09\%$ and $0.99 \pm 0.00\%$ for *solanum melongena* (round

variety) and *solanum melongena* (oval variety) by Agoreyo *et al.*, (2012). However, the results proved otherwise from 5.77% reported for *solanum aethiopicum* by Eze & Kanu (2014). Alkaloids have an amazing effects on humans such pharmacological properties includes anti-malaria, anti-asthma, anti-cancer, anti-inflammatory, anti-bacterial, analgesic just to mention few (Haruna *et al.*, 2016). Alkaloids have a wider range of pharmacological properties and Eggplant could serve as a supplement in dietary diet.

The Flavonoids values obtained were 2.03 ± 0.40% and 0.28 ± 0.00% for *solanum gilo* and *solanum melongena* respectively, but the value for *solanum gilo* was higher than the value for *solanum melongena*. The result for *solanum melongena* compared well with the 0.21 ± 0.03% reported by Ndife *et al.*, (2019), slightly lower than 0.40 ± 0.01% and 0.46 ± 0.02% reported by Udeme *et al.*, (2013) and Oyeyemi *et al.*, (2015) respectively. The 19.50 ± 0.02% reported by Eze & Kanu (2015) was high compared with the results of this study. Flavonoid has much health promoting effects which include anti-allergic, anti-oxidant, anti-inflammatory, anti-cancer and antiviral effects (Udeme *et al.*, 2013). However, Flavonoid are thermal sensitive, increases in heat lead to decreases in concentration if it in the fruits (Ndife *et al.*, 2019). Cardiac glycoside observed were the same value; 1.20 ± 0.00% for *solanum gilo* and *solanum melongena* respectively. The results were compared well with the 1.67 ± 1.67% for *solanum lycopersicum* by Clementina *et al.*, (2017), and lower than 4.70 ± 0.21% reported for *solanum gilo* by Eze & Kanu (2015). Cardiac glycosides work by inhibiting the Na⁺/K⁺ pump. This inhibition increases the amount of Ca⁺ ions available for the heart muscle, improves cardiac output and reduces distention of the heart (Haruna *et al.*, 2016). Glycosides are thermal sensitive, boiling reduces it concentration from the fruits, hence, making it less harmful for consumption (Shalom *et al.*, 2011). Oxalate contents obtained from the analysis is 0.07 ± 0.00% for the *solanum gilo* and *solanum melongena* respectively. The results are the same with the 0.07 ± 0.00% reported by Ndife *et al.*, (2019), and very low from the 23 ± 0.01% and 23.97 ± 0.5% reported for *solanum incanum* by Auta *et al.*, (2011) and Agoreyo *et al.*, (2012) respectively. Oxalate could be toxic when consumed in raw fruits (Clementina *et al.*, 2017) and can bind calcium, magnesium, iron,

and zinc making them unavailable (Agoreyo *et al.*, 2012). Also, it enhances blood clotting, reduces blood pressure, decreases serum lipid level and modulates immunoresponses (Clementina *et al.*, 2017).

The Tannins composition obtained from the analysis were 32.28 ± 0.22% and 64.43 ± 0.06% for *solanum gilo* and *solanum melongena* respectively, but the value for *solanum gilo* was very low than the value for *solanum melongena*.

The results obtained was high compared with

12.82 ± 0.14% and 3 ± 0.14% reported by Agoreyo *et al.*, (2012); Eze & Kanu (2014) respectively. Tannins have shown physiological astringent and haemostatic properties, that enhances the healing of wounds and ameliorated inflamed mucus membrane (Eze & Kanu (2014). The high level of Tannin in *solanum melongena* shows that the fruits could be a good source of Tannins.

The levels of steroids in the two species differs greatly from one another, 77.83 ± 1.15% for *solanum gilo* and 21.10 ± 0.36% for *solanum melongena*. However, the results obtained was high compared with 1.68 ± 0.06% and 1.92 ± 0.00% reported for *solanum anguivi* by Oyeyemi *et al.*, (2015) and Ndife *et al.*, (2019). Steroid has shown anti-inflammatory properties and can regulate carbohydrate and proteins metabolism Oyeyemi *et al.*, (2015).

Minerals Content

The result of the mineral composition of *solanum gilo* and *solanum melongena* in table 4.3 shows the phosphorous, calcium, Magnesium, Iron, Sodium, Potassium and Zinc are statistically significantly different at $P < 0.05$.

Table 4.3: Mineral Contents of *Solanum Gilo* and *Solanum Melongena* fruits

S/n	Parameter	<i>Solanum</i> (mg/Kg)	<i>Gilo</i>	<i>Solanum</i> (mg/Kg)	<i>Melongena</i>
1.	Phosphorous	0.68 ± 0.04 ^a		0.37 ±	0.02 ^b
2.	Calcium	8.73 ± 0.07 ^a		4.77 ±	0.10 ^b
3.	Magnesium	19.33 ± 0.12 ^a		13.83	± 0.15 ^b
4.	Sodium	37.66 ± 0.88 ^a		46.33	± 0.67 ^b
5.	Potassium	45.33 ± 0.67 ^a		61.33	± 1.20 ^b

6.	Iron	1.92 ± 0.01^a	$1.13 \pm$	0.01^b
7.	Zinc	0.43 ± 0.01^a	0.27 ± 0.01^b	
8.	Manganese	0.39 ± 0.00^a	0.34 ± 0.01^b	
9.	Copper	0.19 ± 0.01^a	0.21 ± 0.12^b	

Values are mean \pm SD for three replications and values with different superscript are statistically different at $P < 0.05$.

Phosphorous contents from the study showed 0.68 ± 0.04 mg/Kg and 0.37 ± 0.02 mg/Kg for *solanum gilo* and for *solanum melongena* respectively. The result for *solanum gilo* was high compared with the result for *solanum melongena*. The result for *solanum melongena* falls in line with 0.325 mg/Kg reported for *solanum macranthum* by Kalebar et al., (2019). The results obtained in this study were lower compared with 650.86 ± 1.61 mg/Kg reported for *solanum anguivi* by Oyeyemi et al., (2015), and the 25000 mg/Kg amount required for diet by NAFDAC, (2012). Phosphorous is an essential mineral element that forms part of DNA and RNA as well as helps in the formation of strong bones and teeth (Haruna et al., 2016).

Calcium composition from the investigation revealed 8.73 ± 0.07 mg/Kg and 4.77 ± 0.10 mg/Kg for *solanum gilo* and for *solanum melongena* respectively. The result for *solanum gilo* was high compared with the result for *solanum melongena*. The results were high compared with the result 0.49 ± 0.01 mg/Kg reported for *solanum anguivi* by Oyeyemi et al., (2015). However, the results obtained were lower compared with 498 ± 11.17 mg/100g and 873.33 ± 16.67 mg/100ml reported by Shalom et al., (2011) and Achikanu et al., (2013) respectively, also the 30000 mg/Kg amount required for diet by NAFDAC. Calcium is essential mineral for development of bones and teeth, also for the prevention of rickets in children and Osteomalacia in adults (Agoreyo et al., 2012 and Haruna et al., 2016).

Magnesium values obtained were 19.33 ± 0.12 mg/Kg and 13.83 ± 0.15 mg/Kg for *solanum gilo* and *solanum melongena* respectively. *Solanum gilo* value obtained was high compared with value obtained for *solanum melongena*. The result for *solanum gilo* compared well with 19.8 ± 0.10 mg/Kg reported for *solanum aethiopicum* by Shalom et al., (2011), while, the result for *solanum*

melongena almost compared well with 12.77–0.13mg/Kg reported by Nimenibo-Uadia & Omotayo, (2017). Both results were lower compared with the 20000mg/Kg amount required for diet by NAFDAC, (2012). Magnesium is an activator of many enzymes and maintains the electrical potential in nerves required for body's muscular contraction Ozioma *et al.*, (2013) and Udeme *et al.*, (2013). Also it prevents mental depression and muscular tremor Nimenibo-Uadia & Omotayo, (2017).

Sodium contents obtained from the study revealed 37.67–0.88mg/Kg and 46.33–0.67mg/Kg for *solanum gilo* and for *solanum melongena* respectively. The value obtained for *solanum melongena* was high compared with the value obtained for *solanum gilo*, the results were higher compared with 0.03–0.00mg/Kg reported for *solanum anguivi* by Oyeyemi *et al.*, (2015). The results from the study showed lower values when compared with 270000 –1.41mg/Kg and 4310mg/Kg and reported by Eze & Kanu, (2015); Ndife *et al.*, (2019) respectively. Also, the results were lower to 30000mg/Kg amount required for diet by NAFDAC, (2012). Sodium helps in the transmission of nerve impulses and brings about Osmotic balance of the cells in living tissues (Achikanu *et al.*, 2013; Haruna *et al.*, 2016). The low Sodium concentration is nutritionally ideal for hypertensive patient and high level causes high blood pressure Udeme *et al.*, (2013).

Potassium contents obtained showed 45.33–0.67mg/Kg and 61.33–1.20mg/Kg for *solanum gilo* and *solanum melongena* respectively. *Solanum melongena* value was high compared with the value for *solanum gilo*. The results obtained for both *solanum gilo* and *solanum melongena* were very high compared with 2.03–0.03mg/Kg reported for *solanum anguivi* by Oyeyemi *et al.*, (2015), also, the two results were lower than 25000mg/Kg amount required for diet by NAFDAC, (2012). Potassium is the principal cation in intracellular fluid and functions in acid base balance, regulation of osmotic pressure and muscle contraction (Achikanu *et al.*, 2013; Haruna *et al.*, 2016). Potassium has a protective effect against excessive Sodium intake and therefore, preventing high blood pressure (Agoreyo *et al.*, 2012; Ndife *et al.*, 2019).

Iron values obtained were 1.92 ± 0.01 mg/Kg for *solanum gilo* and 1.13 ± 0.01 mg/Kg for *solanum melongena* respectively, the value of *solanum gilo* compared well with the value of *solanum melongena*. The result for *solanum gilo* was low compared with 19.6 ± 0.6 mg/Kg reported by Agoreyo et al., (2012) and high compared with 0.0025 mg/Kg reported for *solanum macranthum* by Kalebar et al., (2019) respectively. The result for *solanum melongena* was low compared with 10.2 ± 0.02 mg/Kg reported for *solanum aethiopicum* by Shalom et al., (2011). Iron is very essential in the formation of haemoglobin and myoglobin, also function in oxygen transportation in the red blood cell (Udeme et al., 2013; Haruna et al., 2016). The recommended daily allowance of Iron for men is 7 mg/day and 12-18 mg/day for women during pregnancy Ozioma et al., (2013). Iron rich food when consumed; prevent anaemia, fatigue, impaired immunity Nimenibo-Uadia & Omotayo, (2017).

Zinc contents obtained were 0.43 ± 0.01 mg/Kg for *solanum gilo* and 0.27 ± 0.01 mg/Kg for *solanum melongena* respectively, the value for *solanum gilo* compared well with the value for *solanum melongena*. The two results obtained were low compared with 2.5 ± 0.001 mg/Kg and 28.15 ± 0.57 mg/kg reported by Agoreyo et al., (2012), and Oyeyemi et al., (2015) respectively. Zinc is required for the proper functioning of the reproduction system and the deficiency may lead to poor growth, impairs immunity and increases morbidity implies an increase in mortality (Agoreyo et al., 2012; Ozioma et al., 2013). Zinc is very useful in protein synthesis, cellular differentiation and replication, also, it is a part of insulin which is required by enzymes (Achikanu et al., 2013; Nimenibo-Uadia & Omotayo 2017).

Manganese contents obtained were 0.39 ± 0.00 mg/kg and 0.34 ± 0.01 mg/kg for *solanum gilo* and *solanum melongena* respectively, the value for *solanum gilo* compared well with the value for *solanum melongena*. The two results were low compared with 1470 ± 0.01 mg/Kg and 0.6 mg/Kg reported for *solanum incanum* by Haruna et al., (2016) and for *solanum lycopersicum* by Clementina et al., (2017) respectively. Manganese supported the immune system, regulated blood sugar level and also involved in the production of energy and cell reproduction (Clementina et al., 2017).

Copper values obtained were 0.19 ± 0.01 mg/kg and 0.21 ± 0.12 mg/kg for *Solanum gilo* and *Solanum melongena* respectively, the value for *solanum gilo* compared well with the value for *solanum melongena*. The two results obtained were low compared with 1.56 mg/Kg reported for *solanum incanum* by Auta *et al.*, (2011) and 5000 mg/Kg amount required for diet by NAFDAC, (2012) standard respectively. Also they were higher than 0.04 mg/Kg reported for *solanum gilo* by Edem *et al.*, (2009). Copper is involved in maintaining cardiovascular health, glucose and cholesterol metabolism (Tamegnon *et al.*, 2012).

CONCLUSION

Phytochemicals analysis revealed the presence of Saponin, Alkaloid, Flavonoid, Cardiac glycoside, Oxalate, Tannin and Steroid, which is an indication that the Eggplants can be useful for therapy purposes. Table 1B the results for phytochemicals obtained indicated higher levels of alkaloid, flavonoid, and steroid for the *solanum gilo* than *solanum melogena*, while, tannin is lower in the *solanum gilo* than *solanum melongena*, but the same levels for saponin, cardiac glycoside and oxalate, hence, the results revealed that *solanum gilo* contained higher levels of the beneficial phytochemicals than *solanum melongena*. The Eggplants are sources of important minerals needed by the body especially Calcium, Magnesium and Potassium with high predicted bioavailability. Phosphorous, Zinc, Iron, Manganese, and Copper, were low. Table 2, the results for mineral contents show higher levels of phosphorous, calcium, magnesium, iron, zinc and manganese for *solanum gilo* than *solanum melongena*, while, lower levels for sodium, potassium and copper in the *solanum gilo* than *solanum melongena*. Furthermore, the results show that *solanum gilo* contained higher levels of the mineral elements than *solanum melongena*. In conclusion, the results obtained from the comparative assessment of the phytochemicals and mineral elements of the Eggplant species (*solanum gilo* and *solanum melongena*) revealed that the *solanum gilo* contained an appreciable

number of phytochemicals and mineral elements than *solanum melongena*.

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