Comparative Analysis of the Proximate and Phytochemical Properties of *Solanum Melongena* (Green Garden Egg) Organically and Inorganically Cultivated in Ohodo, Igbo – Etiti Local Government Area Enugu State

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Abstract: The nutritional, medicinal, cultural benefits and importance of *Solanum melongena* cannot be over emphasized. The study ascertained the proximate and phytochemical compositions of organically and inorganically cultivated *S. melongena* using standard procedures. Eight plots, each measuring 60ft by 40ft were used for the study. Two plots were cultivated in each of the four cardinal (East, West, North and South) locations of the town. This is done based on the geographical reconnaissance of the area. All the eight plots were cultivated during the early rainy season on March 15, 2025. Proximate and phytochemiacal analysis were carried out on the harvested garden eggs. The carbohydrate, protein and ash contents of organically cultivated *S. melongena* are respectively 80.94 ± 4.23 mg/100g, 3.83 ± 0.58 mg/100g and 2.45 ± 8.31mg/100g while their respective contents in inorganically cultivated *S. melongena* are 79.00 ± 2.61 mg/100g, 3.02 ± 3.02 mg/100g and 2.40 ± 2.22 mg/100g. Also, the moisture, fat and fiber contents of inorganically cultivated *S. melongena* are higher when compared with the organically cultivated *S. melongena*. The concentrations of phytochemical compounds are higher in organically cultivated *S. melongena* than in inorganically cultivated *S. melongena*. For instance, alkaloids (4.78 ± 3.87 mg/100 g), phenol (6.10 ± 3.97 mg/100g) and saponins (3.09 ± 0.43 mg/100 g) were higher in organically cultivated *S. melongena* than in inorganically cultivated *S. melongena* where alkaloids (4.52 ± 4.57 mg/100g), phenol (5.96 ± 7.03 mg/100g) and saponins (3.00 ± 8.65 mg/100g) are lower. In conclusion, the result revealed that *S. melongena* is rich in nutrients and phytochemicals which must have accounted for their medicinal properties.

Keywords: *Solanum Melongena, Proximate, Phytochemicals, Organic Cultivation and Inorganic Cultivation.*

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I. INTRODUCTION

The vegetable originated (*Solanum melongena*) from tropical Africa and got its name from egg like shaped (Agorejo *et al*., 2012). The garden egg is widely consumed and culturally significant fruit in West Africa and other tropical regions, particularly Nigeria. While this species is part of the vast Solanum genus, which includes over 1,000 species globally, its origins are rooted in tropical Africa (Sękara *et al*., 2020). The genus Solanum is highly diverse on the African continent, with numerous species being indigenous to the region and utilized for food and traditional medicine. In 2022, global eggplant production was reported at approximately 59.3 million metric tons, underscoring its worldwide importance as a vegetable crop (FAO, 2024).

Beyond its role as a food source, the African garden egg is deeply embedded in the traditional culture of sub-Saharan Africa. Consumed raw, boiled, or fried, it is a staple ingredient in various stews, soups, and sauces. In communities such as Ohodo in Igbo-Etiti, and across many West African cultures, the garden egg transcends its dietary

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function, serving as a symbol of hospitality and cultural heritage (Henry *et al*., 2022).

The ethnobotanical importance of *S. melongena* is well-documented, with traditional medicine employing it for a range of health applications, from managing weight to treating conditions like asthma, skin infections, and gastrointestinal issues. Modern pharmacological studies have substantiated many of these traditional uses, demonstrating that eggplant extracts possess significant analgesic, anti-inflammatory, hypoglycemic, and hypolipidemic properties (Gürbüz *et al*., 2018). These therapeutic effects are largely attributed to the fruit's rich composition of bioactive compounds, including dietary fiber, ascorbic acid, phenols, and anthocyanins (Docimo *et al*., 2022). Given its multifaceted value, the agricultural methods used in its production warrant careful examination.

To understand the nutritional and therapeutic value of a food, two key evaluations are often performed: proximate and phytochemical analysis. Proximate analysis determines the major macronutrient components of a food, including its moisture, ash, crude protein, fat, and fiber content (Ajah *et al* 2015; Nwobasi and Attamah, 2017; Olayanju *et al*., 2020). Concurrently, phytochemical analysis identifies and quantifies the non-nutritive, plant-derived compounds responsible for a plant's defense mechanisms and many of its health benefits. These phytochemicals are recognized for their antioxidant, antimicrobial, cholesterol-lowering, and anti-inflammatory activities (Jarret, 2016; Amobi *et al*., 2021).

Given the widespread acceptance and use of *S. melongena* for nutritional, traditional, and medicinal purposes in Nigeria, many farmers have increasingly adopted the use of various agrochemicals to boost yields and profitability, often without considering the potential health implications. Although numerous studies have reported on the nutritive and phytochemical content of the fruit, there is a significant gap in the literature regarding a direct comparison between the proximate and phytochemical compositions of *S. melongena* cultivated through organic versus inorganic farming methods. Such an evaluation is critical to fully elucidate its dietary importance and its contribution to human health.

II. MATERIALS AND METHODS

- *The Study Area*

The study was carried out in Ohodo agro-ecological zone, in Igbo Etiti L. G. A. of Enugu state and it is located on latitude 6.71ºN and longitude 7.42ºE. Ohodo people are predominantly farmers cultivating tomatoes, garden eggs, yellow pepper, yams and other vegetables.

- *Sample Collection and Preparation*

Fresh samples of garden eggs (*S. melongena*) cultivated organically and inorganically were harvested from the experimental sites and the crops authenticated at the Department of Crop Science, University of Nigeria Nsukka. The fruit stalks and all unwanted particles were removed. The fruits were diced and portion of the fresh samples was isolated for the moisture content determination, while the rest samples were air-dried. The air-dried samples were pulverized, using an electric grinder. The powders were stored in air-tight container in refrigerator for further analysis like the proximate and phytochemical analyses.

- *Proximate Analysis*

Moisture, ash, crude fat and crude fibre were determined in accordance with the official methods of the Association of Official Analytical Chemists [17]. Moisture content was determined by oven drying of 200g of each sample to a constant weight at 105°C. Crude protein content was determined by Kjeldahl method using 6.25 as the conversion constant after the determination of each sample’s nitrogen using n-hexane as solvent. The ash content was determined gravimetrically after ignition at 550°C. Carbohydrate content was calculated by difference. All analyses were carried out in triplicates.

- *Experimental Design*

Eight plots, each measuring 60ft by 40ft were used for the study. Two plots were cultivated in each of the four cardinal (East, West, North and South) locations of the town. This is done based on the geographical reconnaissance of the area. At each location, one plot was inorganically treated (i.e inorganic fertilizer, herbicides, pesticides, etc were used) while the other was organically treated. Here, there were no synthetic inputs (i.e no application of inorganic fertilizer, herbicides, insecticides, etc) in the organically treated plots, but animal dugs were used as manure source to enrich the soil, and weeding was done manually with the aid of hoe. All the eight plots were cultivated in early rainy season on March 15, 2025.

III. RESULT

- *Proximate Analysis*

The results obtained from the proximate composition of the garden eggs (*S. melongena*) organically and inorganically cultivated revealed that both contain ash, moisture, fat, fiber, protein and carbohydrate in different proportions. The ash (2.45 ± 8.31mg/100g), protein (3.83 ± 0.58 mg/100g) and carbohydrate (80.94 ± 4.23 mg/100g) contents are higher in organically cultivated *S. melongena* than in inorganically cultivated garden egg. On the other hand, the moisture (6.23 ± 0.11 mg/100g), fat (4.90 ± 4.89 mg/100g) and fiber (4.45 ± 2.18 mg/100g) compositions are higher inorganically cultivated than in organically cultivated *S. melongena*. Organically cultivated *S. melongena* has low moisture content than the inorganically cultivated.

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Table 1 Proximate Analysis of Organic and Inorganic Cultivated *S. Melongena* (mg/100g)

	Ash	**Moisture**	**Fat**	**Fiber**	**Protein**	**Carbohydrate**
Organic	2.45 ± 8.31	5.19 ± 9.43	3.49 ± 6.76	4.10 ± 1.12	3.83 ± 0.58	80.94 ± 4.23
Inorganic	2.40 ± 2.22	6.23 ± 0.11	4.90 ± 4.89	4.45 ± 2.18	3.02 ± 3.02	79.00 ± 2.61

Each value is the mean ± standard error of four replicates

➢ *Phytochemical Analysis*

Phytochemical compositions (alkaloids, flavonoids, tannins, phenols, saponins glycosides and steroids) were detected in varying quantities in the organically and inorganically cultivated *S. melongena* in Ohodo as shown in Table 2. Steroids and phenols have higher concentrations in both cultivation types. Steroids and phenols respectively have 6.00 ± 7.01 mg/100g and 6.10 ± 3.97 mg/100g concentrations in organically cultivated *S. melongena* while their concentrations in inorganically cultivated *S. melongena* are respectively 6.00 ± 0.98 mg/100g and 5.96 ± 7.03 mg/100g. Also, taninns has the least concentration in both organically cultivated *S. melongena* (0.31 ± 6.11 mg/100g) and inorganically cultivated *S. melongena* (0.30 ± 3.14 mg/100g).

Table 2 Quantitative Analysis of Organic and Inorganic Cultivated *S. Melonegena* (mg/100g)

Parameters	**Organically cultivated *S. melongena***	**Inorganic cultivated *S. melongena***
Flavonoids	2.06 ± 1.23	2.05 ± 0.54
Saponins	3.09 ± 0.43	3.00 ± 8.65
Taninns	0.31 ± 6.11	0.30 ± 3.14
Alkaloids	4.78 ± 3.87	4.52 ± 4.57
glycosides	2.00 ± 1.08	2.00 ± 3.52
Steroids	6.00 ± 7.01	6.00 ± 0.98
Phenols	6.10 ± 3.97	5.96 ± 7.03

Each value is the mean ± standard error of four replicates

IV. DISCUSSION

The proximate analysis of *Solanum melongena* from both organic and inorganic cultivation revealed the presence of ash, moisture, fat, fiber, protein, and carbohydrates, albeit in differing proportions. This general finding aligns with the work of Obembe *et al*. (2023), who documented similar nutritional components in five species of the Solanaceae family. However, the moisture content observed in this study was considerably lower than the high levels reported by Obembe *et al*. (2023) for *S. melongena*. The moderate moisture content in our samples is nonetheless consistent with the general understanding that eggplant fruits are rich in water (Sharma and Kaushik, 2021). Furthermore, our findings contribute to the body of evidence, such as that provided by Henry *et al*. (2022), demonstrating significant nutritional variability across different Solanum species.

The lower moisture content observed in the organically cultivated *S. melongena* is particularly noteworthy. A reduced moisture level is a key factor in inhibiting the growth of microorganisms, thereby preventing spoilage. This principle is well-established, as the water activity of a food product is a primary determinant of its stability and susceptibility to microbial contamination (Rahman and Al-Farsi, 2020). Consequently, the lower moisture in these fruits may contribute to an extended shelf life. The variations in nutritive composition between the two cultivation methods likely stem from differing agricultural inputs, such as the application of natural versus synthetic fertilizers, and other environmental conditions during growth (Lombardo *et al*., 2019).

The protein content in both organically and inorganically grown *S. melongena* was found to be appreciable and is comparable to levels reported in other recent studies (Kumar and Singh, 2022). As a fundamental dietary component, protein supplies essential amino acids required for tissue repair, immune function, and overall physiological regulation. The protein levels in the samples suggest that *S. melongena* can serve as a valuable supplementary protein source in human diets.

In this study, the ash content of the garden egg was within the range reported by Adeyeye *et al*. (2020). This finding also corroborates the understanding that ash content serves as a direct indicator of a food's total mineral composition (Nielsen, 2019). Therefore, the modest ash levels observed suggest a corresponding moderate mineral profile in the fruit samples.

Notably, the fat and fiber contents in our samples diverged from the findings of Obembe *et al*. (2023) and Adeyeye *et al*. (2020), who reported different levels in their respective analyses of eggplant species. The high fiber content found in this study is particularly significant due to its well-documented health benefits. Dietary fiber is crucial for maintaining intestinal motility and has been strongly linked to a reduced risk of coronary heart disease, hypertension, and type 2 diabetes (Reynolds *et al*., 2019). Similarly, the high carbohydrate content of the garden eggs in this study contrasts with the lower levels reported by Obembe *et al*. (2023) and Adeyeye *et al*. (2020) for other eggplant varieties. This high carbohydrate concentration indicates that *S. melongena* can be an effective source of dietary energy.

The phytochemical screening of the samples confirmed the presence of several bioactive compounds, which aligns with recent research identifying *S. melongena* as a rich source of phenolics and other valuable secondary metabolites

(Plazas *et al*., 2019). The phytochemical compositions in this study agrees with Okwor *et al*. 2025 and Ishiwu *et al*, 2025 who researched on the phytochemical compositions of different botanicals used in field crop protection and found moderate levels of each compositions. However, the overall phytochemical concentration in our study was lower than the high levels reported by Obembe *et al*. (2023). This result also corroborates with Hussain *et al*. (2018) who worked on the role of plant derived alkaloids and their sources and reported low to moderate phytochemicals. The presence of these compounds, even at modest levels, substantiates the fruit's medicinal applications, as phytochemicals are known to exhibit analgesic, anti-inflammatory, and antimicrobial properties (Gürbüz *et al*., 2018).

V. CONCLUSION AND RECOMMENDATIONS

The presence of valuable proximate components and bioactive compounds in both organically and inorganically grown garden eggs justifies their widespread consumption. The levels of crude protein, fat, fiber, and carbohydrates indicate that the fruit is a beneficial source of energy and nutrients essential for human growth and health. Therefore, this study recommends the development of educational initiatives for farmers on the judicious use of synthetic inputs to ensure consumer safety. Furthermore, public awareness campaigns are recommended to enlighten consumers about taking precautionary measures to ensure the safety of the agricultural produce they consume.

CONFLICT OF INTEREST

There is no conflict of interest.

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