



NUTRITIONAL COMPOSITION OF *Cucumis sativus* L. AND *Solanum melongena* L. FRUITS

CHINEDU IMO*, CHRISTOPHER SHAIBU AND KHADIYAT SANDA YUSUF

Department of Biochemistry, Faculty of Pure and Applied Sciences, Federal University Wukari, Nigeria.

ABSTRACT

This study investigated the nutritional composition of *Cucumis sativus* L. fruit and *Solanum melongena* L. fruit. The fruits were purchased in Wukari, Nigeria. They were sun-dried and processed for the various analysis. The amino acids analyses were carried out with the use of HPLC, while vitamin and proximate analyses were carried out with the use of AOAC methods. *Cucumis sativus* fruit is higher in moisture and carbohydrates than *Solanum melongena* fruit, while *Solanum melongena* fruit is higher in crude protein, crude fibre, crude lipid and ash than *Cucumis sativus* fruit. *Cucumis sativus* fruit is higher in vitamin A, B3, B5, B6, B7, D and K than *Solanum melongena* fruit, while *Solanum melongena* fruit is higher in vitamin B1, B2, B9, B12, C and E than *Cucumis sativus* fruit. *Cucumis sativus* fruit is higher in methionine, threonine and isoleucine than *Solanum melongena* fruit, while *Solanum melongena* fruit is higher in lysine, leucine, phenylalanine, valine, tryptophan, histidine, arginine, serine, cysteine, tyrosine, alanine, aspartic acid, glutamic acid, glycine and proline than *Cucumis sativus* fruit. This study showed the various importance of the two fruits in general nutrition due to the presence and appreciable amounts of some essential nutrients in them.

KEYWORDS: Amino acids; *Cucumis sativus*; Nutrient; *Solanum melongena*; Vitamin.

INTRODUCTION

Consumption of fruits and products derived from fruits has been associated especially in recent times with several health benefits [1, 2]. This has given fruits a prominent place in making the choice of balanced and healthy diets. Fruits are consumed either for their nutritional composition or their palatability and have been reported to be a good source of phytochemicals, vitamins, minerals, amino acids and biomolecules [2 - 4].

Solanum melongena fruit also known as African eggplant or garden eggplant is a fruit vegetable that belongs to the family of Solanaceae and the genus Solanum [5]. The plant is grown in Asia, African and Europe and has over 1000 species with about 100 grown in Africa. Of these, about 25 species are represented in Nigeria including *S. melongena*, *S. aethiopicum*, *S. macrocarpon*, *S. incanum* [5, 6]. These species vary in characters like diameter of corolla, petiole length, leaf blade width, plant branching, fruit shape and fruit colour at harvesting

[7]. The fruit is consumed raw as vegetable salad or boiled and served with other foods. In some cultures, it is served to visitors as a token of goodwill [8]. *Solanum melongena* fruit is commonly consumed in many rural and urban families and has been reputed traditionally to have therapeutic applications in humans ranging from reduction of weight, asthma, allergic rhinitis, nasal congestion, constipation and hyperlipidaemia [9-11].

Cucumis sativus fruit commonly called cucumber is a fruit vegetable cultivated as an annual crop in subtropical and tropical regions [12]. They belong to the gourd family Cucurbitaceae alongside crops like melon, pumpkins and Squash. *Cucumis sativus* is a creeping vine that bears fruits used for different purposes. It is consumed either as vegetable salad or as part of the blends for a nutritionally rich fruit juice. There are two main varieties of cucumber: the slicing and the pickling varieties. The fruit is cylindrical, with tapered ends and can be as large as 60cm long and 10cm in diameter [13]. *Cucumis sativus* fruit have been reported to be a good source

*Corresponding author: chinedu04@yahoo.com; +2348037505543

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of phytochemicals like alkaloids, tannins, steroids and phenols [4]. The fruit has also been shown to have medicinal and therapeutic potentials including prevention/treatment of inflammation, bacterial infection, diabetes mellitus, lipid peroxidation, fever, constipation and hepatopathy [14, 12, 4].

Considering that in many urban and rural families, *Cucumis sativus* and *Solanum melongena* fruit are consumed and as close substitutes, it is pertinent therefore to analyse and compare their nutritional composition and potential health benefits. This therefore warrants research into the present study.

MATERIALS AND METHOD

Plant materials used

Cucumis sativus fruit and *Solanum melongena* fruit were purchased in Wukari, Nigeria. The fruits were identified at the Biological Science Department, Federal University Wukari, Nigeria. They were sun-dried, processed into powder using manual blender and stored in air-tight containers until required for analysis.

Determination of proximate, vitamin and amino acids composition of *Cucumis sativus* fruit and *Solanum melongena* fruit.

The proximate composition (such as protein, ash, moisture, lipid, fibre and carbohydrates) were determined using the method of AOAC [15]. The amino acids profile was determined using HPLC, while vitamin concentrations were determined using the method of AOAC [16].

Statistical analysis

After the proximate, vitamin and amino acids analysis, the results were analyzed statistically using Paired-Samples T Test with the use of Statistical Package for Social Sciences (SPSS) version 21. Means for each parameter were compared for significance at $p \leq 0.05$ and result presented as mean \pm standard deviation.

RESULTS

The results are depicted in Tables 1-3. Results showed that *Cucumis sativus* fruit is high in moisture and carbohydrates than *Solanum melongena* fruit, while *Solanum melongena* fruit is high in crude protein, crude fibre, crude lipid and ash than *Cucumis sativus* fruit. The results also showed that *Cucumis sativus* fruit is high in vitamin A, B3, B5, B6, B7, D and K than *Solanum melongena* fruit, while *Solanum melongena* fruit is high in vitamin B1, B2,

B9, B12, C and E than *Cucumis sativus* fruit. Additionally, the results showed that *Cucumis sativus* fruit is high in methionine, threonine and isoleucine than *Solanum melongena* fruit, while *Solanum melongena* fruit is high in lysine, leucine, phenylalanine, valine, tryptophan, histidine, arginine, serine, cysteine, tyrosine, alanine, aspartic acid, glutamic acid, glycine and proline than *Cucumis sativus* fruit.

DISCUSSION

Results of proximate composition of *Cucumis sativus* and *Solanum melongena* fruits (Table 1) showed that *Cucumis sativus* had a higher moisture content and carbohydrates concentration. *Solanum melongena* however was shown to have a higher concentration of crude proteins, crude fibre, crude lipid and ash. Result of the proximate composition of *Cucumis sativus* in this study when compared to some other studies showed that the moisture content (though on dry weight basis) was much lower than the 94.2% reported by Agatemor *et al.* [4], the crude fibre, crude proteins, ash and crude lipid however compares favourably with the works of Okoye [17], Onimisi and Ovansa [18] and Abbey *et al.* [19]. The moisture content of *Solanum melongena* reported in this work is higher than the 6% reported by Eze and Kanu [8] for *Solanum aethiopicum*, but lower than values report by Jose *et al.* [20] for *Solanum melongena*. The crude fibre, crude proteins, ash and crude lipid however compares well with the result of Adeyeye and Fagbohun [21], Agoreyo *et al.* [22] and Jose *et al.* [20]. The result of the analysis of proximate composition of both fruits is an indication that *Solanum melongena* may be considered a better source of proteins, lipids, ash (minerals) and fibre than *Cucumis sativus* fruit and may support the functions of these parameters accordingly in animals. Dietary fibres are essential in lowering serum cholesterol, enhancing a good bowel health and regulating blood glucose level [23].

Results for concentration of vitamins (Table 2) showed that both fruits contained appreciable amounts of vitamins corroborating their consumption as an essential requirement for healthy and balanced diet. Values for concentration of vitamins obtained for *Solanum melongena* were found to be higher than those for other species of *Solanum* reported by Offor and Igwe [24] and Auta and Ali [25]. The concentration of vitamins for *Cucumis sativus* fruit in this study also compares well with the report of Raaz *et al.* [1]. *Cucumis sativus* fruit was shown to have significantly higher concentration of vitamin A, B₃, D and K than *Solanum melongena* fruit. *Solanum*

Table 1: Proximate composition of *Cucumis sativus* fruit and *Solanum melongena* fruit (%)

	<i>Cucumis sativus</i> fruit	<i>Solanum melongena</i> fruit
Moisture content	10.24 ± 0.01 ^a	10.15 ± 0.00 ^b
Crude protein	7.86 ± 0.01 ^a	8.20 ± 0.00 ^b
Crude fibre	12.41 ± 0.01 ^a	13.63 ± 0.01 ^b
Crude lipid	3.46 ± 0.01 ^a	4.20 ± 0.00 ^b
Ash	7.51 ± 0.01 ^a	8.48 ± 0.00 ^b
Carbohydrates	58.54 ± 0.03 ^a	55.35 ± 0.01 ^b

Values are mean ± standard deviation (n=3).

Mean in the same row having different letters of the alphabet as superscript are statistically significant (p<0.05).

Table 2: Concentrations of vitamins in *Cucumis sativus* fruit and *Solanum melongena* fruit (mg/100g)

Vitamin	<i>Cucumis sativus</i> fruit	<i>Solanum melongena</i> fruit
A (IU/kg)	5241.365 ± 0.02 ^a	4752.640 ± 0.01 ^b
B1	0.085 ± 0.00 ^a	0.092 ± 0.00 ^a
B2	0.150 ± 0.01 ^a	0.215 ± 0.01 ^b
B3	0.655 ± 0.01 ^a	0.460 ± 0.01 ^b
B5	0.039 ± 0.00 ^a	0.035 ± 0.00 ^a
B6	0.245 ± 0.01 ^a	0.200 ± 0.01 ^a
B7	0.320 ± 0.01 ^a	0.285 ± 0.01 ^a
B9	0.055 ± 0.00 ^a	0.061 ± 0.00 ^a
B12	0.350 ± 0.01 ^a	0.365 ± 0.01 ^a
C	18.655 ± 0.01 ^a	21.460 ± 0.01 ^b
D	3.255 ± 0.01 ^a	2.960 ± 0.01 ^b
E	19.350 ± 0.01 ^a	22.415 ± 0.01 ^b
K	26.295 ± 0.02 ^a	25.640 ± 0.01 ^b

Values are mean ± standard deviation (n=3).

Mean in the same row having different letters of the alphabet as superscript are statistically significant (p<0.05).

Table 3: Concentrations of amino acids in *Cucumis sativus* fruit and *Solanum melongena* fruit (mg/100g)

Amino acid	<i>Cucumis sativus</i> fruit	<i>Solanum melongena</i> fruit
Lysine	3.41 ± 0.01 ^a	3.64 ± 0.01 ^b
Methionine	0.91 ± 0.01 ^a	0.88 ± 0.01 ^a
Threonine	2.21 ± 0.01 ^a	2.11 ± 0.01 ^b
Isoleusine	3.11 ± 0.01 ^a	2.76 ± 0.01 ^b
Leusine	7.62 ± 0.02 ^a	8.36 ± 0.01 ^b
Phenylalanine	4.02 ± 0.02 ^a	9.34 ± 0.01 ^b
Valine	4.11 ± 0.01 ^a	5.36 ± 0.01 ^b
Tryptophan	3.01 ± 0.01 ^a	4.02 ± 0.01 ^b
Histidine	1.92 ± 0.02 ^a	2.23 ± 0.01 ^b
Arginine	4.01 ± 0.01 ^a	5.32 ± 0.01 ^b
Serine	2.91 ± 0.01 ^a	3.63 ± 0.01 ^b
Cysteine	0.51 ± 0.01 ^a	0.78 ± 0.01 ^b
Tyrosine	3.21 ± 0.01 ^a	3.57 ± 0.01 ^b
Alanine	3.55 ± 0.01 ^a	3.84 ± 0.02 ^b
Aspartic acid	8.04 ± 0.01 ^a	10.45 ± 0.00 ^b
Glutamic acid	8.55 ± 0.02 ^a	9.05 ± 0.01 ^b
Glycine	3.88 ± 0.01 ^a	4.00 ± 0.00 ^a
Proline	2.13 ± 0.01 ^a	3.05 ± 0.01 ^b

Values are mean ± standard deviation (n=3).

Mean in the same row having different letters of the alphabet as superscript are statistically significant (p<0.05).

melongena fruit however had higher concentration of vitamin B₂, C and E indicating that *Solanum melongena* may have a higher antioxidant activity than *Cucumis sativus* fruit because of their higher concentration of vitamin C and E [26, 27]. Although this alone is not enough to determine total antioxidant activity. There were no significant differences in all the other vitamins analysed between the two fruits.

Both *Cucumis sativus* and *Solanum melongena* fruits were shown to contain considerable concentrations of both essential and non-essential amino acids (Table 3). Of the 18 amino acids analysed, cysteine was found to be the lowest in concentration and glutamic acid the highest in concentration for *Cucumis sativus* fruit, while aspartic acid was found to be the highest in concentration and cysteine the lowest in concentration for *Solanum melongena* fruit. Results

of amino acids analysis for both fruits compare well with the report of Dahinog *et al.* [28] and Ito *et al.* [2], but were lower than those of Ayaz *et al.* [29] who reported a minimum of 4.4mg/100g and a maximum of 298.75mg/100g for seven cultivars of *Solanum melongena* fruits. They however recorded cysteine as being the least in concentration of amino acids found in the fruit, which is in tandem with results of this study. Although both fruits can serve as sources of amino acids to meet up with the daily recommended requirement of amino acids, *Solanum melongena* fruit was found to have higher concentration of both essential and non-essential amino acids than *Cucumis sativus* fruit agreeing with the higher protein content of *Solanum melongena* fruit reported in this study from the proximate composition analysis (table 3) of both fruits. These amino acids help to boost the immune system apart from their nutritional importance. This show the

relevance of both plant parts in nutrition and medicine.

CONCLUSION

This study showed the nutritional relevance of *Cucumis sativus* fruit and *Solanum melongena* fruit. *Solanum melongena* fruit may have a higher antioxidant activity than *Cucumis sativus* fruit because of the higher concentrations of vitamin C and E. *Solanum melongena* fruit has higher concentration of both essential and non-essential amino acids than *Cucumis sativus* fruit. Consumption of the two fruits is encouraged since they possess important nutritional constituents that is essential in general nutrition.

CONFLICTS OF INTEREST

All contributing authors declare no conflicts of interest.

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