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308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorpjn@gmail.com

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Proximate Analysis and Protein Solubility of Four Cucurbits Found in Nigeria

Okoye Ngozi Franca
Department of Biochemistry, University of Port Harcourt, Rivers State, Nigeria

Abstract: Four cucurbits grown in Nigeria namely, cucumber *Cucumis sativus*, snake tomato *Trichosanthes cucumerina*, pumpkins *Cucurbita pepo* and *Cucurbita moschata* were analysed for their nutritive value. Proximate analysis showed that the samples contained on a dry weight basis, protein values of 10.06 to 17.25%. The samples had low lipid content of 0.06 to 5.42%. The samples exhibited high carbohydrate content of 63.06 to 77.85%. Also they contained high moisture 80.43 to 97.80% and high volatile matter 90.33 to 95.50%. The results for ash ranged from 4.50 to 9.67% and then crude fibre from 2.30 to 4.60%. The samples showed minimal protein solubility at pH ranges of 4.0 to 8.0. The samples proved to be of high nutritive value.

Key words: Cucurbits, nutritive value, proximate analysis, protein solubility

INTRODUCTION

Four Nigerian cucurbits, snake tomato *Trichosanthes cucumerina* used for thickening stew, cucumber *Cucumis sativus* eaten mainly as salad, pumpkins *Cucurbita pepo* and *Cucurbita moschata* eaten normally as porridge, were analysed for their nutritive value. Most of the Nigerian cucurbita species are wild but a large number are cultivated. The cucurbitaceae have perhaps more species in cultivation than any other family in Nigeria and are used for diverse purposes in different parts of the country. They occupy a special place in the life and culture of many ethnic groups (Okigbo, 1975; Dahlgren, 1980; Okoli, 1984; Gill, 1988). Some cucurbits can be used as paste or puree for thickening stew or on the other hand for removing hair from hides and skin (Ojinnaka, 1978; Adebooye *et al*., 2005).

In the local dye industry, the rinds of species of cucurbits can be used to imprint designs on clothes. Depending on the species, cucurbits can be used as bath sponges, filters, scrubbers and strainers as well as cleaning of metals (Irvine, 1969; Jefferry, 1980). Some species are used for making house hold utensils such as drinking cups, bowls, basins and ladles. Smoking pipes are also made from the neck of these gourds (Grolier, 1961).

The dry rinds used as floats by various musical instruments are also made from cucurbits and these include flutes, rattles, xylophones and thumb piano (Heiser, 1979).

A few cucurbits are employed as medical plants in Nigeria, these include the African cucumber. The juice from leaves and fruits is given as antihelmintic and the powdered plant is applied externally to malignant ulcers (Oliver, 1960). Dalziel (1937) reported that the root of this same specie is sometimes used as an ingredient in aphrodisiac prescriptions, as an abortifacient, as well as a remedy for uretheal discharges. He also reported that *Luffa aegyptiaca* has tonic and diuretic properties and is emetic in large doses and the fruit contains a bitter purgative principle, luffein, while the leaves or juice are used in traditional treatment of breast cancer. Trichosanthes cucumerina has been found to posses antidiabetic activity (Kirana and Srinivasan, 2008). Kumar *et al.* (2009) stipulated that different parts of the Trichosanthes cucumerina plant can be used to treat liver disorders. They also have the capability to exert a significant protection against ethanol induced gastric damage (Arawwawala *et al*., 2010). Much of the information that is available in food composition tables of nutrient content of local food stuffs does not embrace all the food stuffs from different areas and where available, need updating. In literature, there has been little or no information on edible cucurbits in general. In view of this, the nutritive value of some of these edible cucurbits namely cucumber *(Cucumis sativus)* pumpkins, *(Cucurbita pepo)*, pumpkin (*Cucurbita moschata)* and snake tomato *(Trichosanthes cucumerina)* have been investigated.

MATERIALS AND METHODS

Cucurbita pepo and *Curcurbita moschata* were purchased from Igwurita market in Ikwerre Local Government Area of Rivers State, Nigeria. The *Trichosanthes cucumerina* was obtained during field trips to Ogbogoro farms in Obio/Akpor Local Government Area of Rivers State.

Sample preparation: The cucurbits were washed and their rind discarded. The samples were then cut into slices and dried to a constant weight at 105°C for 48 hrs. The dried samples were then ground into powder and put in dried air tight containers and stored in a cool dry place.

Proximate analysis determination: The moisture content, ash content, crude lipid, crude protein and crude fibre were done following the AOAC (1984) methods. The carbohydrate content in the samples was determined by subtracting the sum of % crude protein, % crude lipid, % ash, % crude fibre from 100%. The volatile matter in the samples was determined by subtracting the %ash from 100%.

Determination of protein solubility: The method of Sathe and Salunkhe (1981) was employed to determine the protein solubility profile of the samples. 20 mg of each of the samples was dissolved in 10 ml of 0.1M HCl or 0.1M NaOH and adjusted with either NaOH or HCl to obtain the desired pH. This was centrifuged at 5000 rotations per minute for 15 min and the protein of the supernatant was determined by Lowry's method (Lowry *et al*., 1951).

Statistical analysis: Each experiment was repeated three times. The results were presented with their means and standard deviation using Microsoft Excel 2007.

RESULTS AND DISCUSSION

Table 1 showed the results of the proximate composition of the various cucurbits analysed. The samples showed high moisture contents with *Cucumis sativus* having the highest moisture content (97.8%) followed by *Trichosanthes cucumerina* (95.04%), *Cucurbita moschata* (89.37%) and *Cucurbita pepo* (80.34%). The rapid spoilage of these cucurbits when stored under ordinary conditions can be attributed to the high moisture content. These results obtained are in accordance with the report of Egan *et al*. (1981) which showed the moisture content of cucumber as 96.4%, tomatoes 93.4% and pumpkin 94.7%. The samples had good or appreciable amount of ash and could be recommended as effective sources of mineral nutrients. *Cucumis sativus* had the highest ash content (9.67%) followed by *Cucurbita pepo* (7.50%) and *Trichosanthes cucumerina* (6.83%) with *Cucurbita moschata* (4.50%) having the lowest. The volatile matter content of the samples were as follows (95.50%) for *Cucurbita moschata*, *Trichosanthes cucumerina* (93.17%), *Cucurbita pepo* (92.50%) while *Cucumis sativus* had (90.33%). The samples had low protein content with *Cucumis sativus* having the highest protein content (17.25%) followed by *Cucurbita moschata* (13.00%), *Trichosanthes cucumerina* (11.13%) and the lowest protein content was obtained from *Cucurbita pepo* (10.06%).

Cucumis sativus had (5.42%) had the highest lipid content followed by *Trichosanthes cucumerina* (1.20%), *Cucur*bita *moschata* (1.05%) and *Cucurbita pepo* had the least (0.60%). These results show that the samples cannot be regarded as oil samples. However, as reported by Yusuf *et al*. (2007), snake tomato seed is an oil seed with appreciable high levels of crude protein and ash. The fibre content of the samples were as follows, *Cucumis sativus* (4.60%), *Cucurbita pepo* (4.30%), *Cucurbita moschata* (3.60%) and *Trichosanthes cucumerina* (2.30%). There was not much variation in the carbohydrates content of the samples. However, *Trichosanthes cucumerina* had the highest (78.54%). The two *Cucurbita* genera almost had the same carbohydrates content with *Cucurbita moschata* (77.85%), *Cucurbita pepo* (77.54%). *Cucumis sativus* had the lowest carbohydrates content (63.06%). This is in line with the work of Hussain *et al*. (2010), which found that *Cucurbita moschata* had higher carbohydrate content than *Cucumis sativus*. From the results obtained, the samples could be regarded as good Carbohydrate sources in human nutrition.

Table 2 showed the effect of pH on the protein solubility of the various cucurbits. The nitrogen solubility values were investigated between the pH range 2 to 10. The lowest values were obtained at pH 2 with *Trichosanthes cucumerina* (0.15 Ug/ml), *Cucumis sativus* (0.11 Ug/ml), *Cucurbita pepo* (0.10 Ug/ml). At pH 10 the samples

Table 1: Proximate composition of the various cucurbit samples (on a dry weight basis)

Samples	Crude protein %	Lipid %	Fibre %	Carbohydrate %	Ash %	Volatile matter %	Moisture %
Trichosanthes cucumerina	11.13±0.13	1.20±0.00	2.30±0.00	78.50±0.20	6.83±0.24	93.17±0.10	95.04±0.06
Cucumis sativus	17.25±0.16	5.42±0.00	4.60±0.00	63.06±0.20	9.67±0.23	90.33±0.20	97.80±0.59
Cucurbita pepo	10.60±0.00	0.60±0.00	4.30±0.00	77.54±0.00	7.50±0.00	92.50±0.00	80.34±0.20
Cucurbita moschata	13.00±0.20	1.05±0.00	3.60±0.00	77.85±0.04	4.50±0.00	95.50±0.00	89.37±0.26

Results are means of three determinations ± SD (standard deviation)

Table 2: Protein solubility [Effect of pH on the nitrogen solubility of the cucurbits (Ug Protein/ml)]

Sample	2	4	6	8	10
Trichosanthes cucumerina	0.15±0.00	0.16±0.00	0.17±0.00	0.16±0.00	0.17±0.00
Cucumis sativus	0.11±0.00	0.12±0.00	0.13±0.00	0.13±0.00	0.12±0.00
Cucurbita pepo	0.10±0.00	0.08±0.00	0.07±0.00	0.08±0.00	0.09±0.00
Cucurbita moschata	0.09±0.00	0.06±0.00	0.08±0.00	0.08±0.00	0.11±0.00

Results are means of three determinations ± SD (standard deviation)

showed increase in nitrogen solubility with *Trichosanthes cucumerina* (0.17 Ug/ml) *Cucumis sativus* (0.12 Ug/ml), *Cucurbita moschata* (0.11 Ug/ml) and *Cucurbita pepo* (0.09 Ug/ml) though at pH 8, the values showed a decrease. This result is in accordance with the work of Abbey and Ibeh (1987). In their work on the protein solubility of raw and heat processed brown bean flour, their samples showed an increase in nitrogen solubility as the pH increased, but at a certain pH, their samples also showed a decrease in the nitrogen solubility. However, protein solubility decreased in their heat processed brown bean flour at every pH studied, this could be as a result of protein denaturation.

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