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ANTI-NUTRITIONAL POTENTIAL, MINERAL ELEMENTS AND PHYTO-CONSTITUENTS OF CUCUMBER FRUITS (*Cucumis sativus*)

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ABSTRACT

Background: Cucumber fruit (*C. sativus*) has since time past consumed as one of the major nutrients provider to a large population across the globe. However, there are traces of anti-nutrients, mineral elements and phytochemicals substances of interest that are responsible for dual functions; reduction of nutrients bioavailability and protective roles.
Specific objectives: The objectives of this research is to investigate the antinutrient potential, minerals and phyto-constituents of the dried-sample of Cucumber *(Cucumis sativus)*.
Materials and Methods: Fresh cucumber fruits were washed with clean water, diced, dried in the oven, due to its high water content. It was macerated with mortal and pestle. The resultant sample was used for anti-nutrients, minerals and phytochemicals screening.
Conclusion: The *in vitro* investigation conducted in this research confirmed the presence of tannins, saponins, flavonoids, alkaloids, cyanogenic glycosides, phytate, oxalate, carbohydrate, protein, fat, crude fibre, ash, moisture content, potassium (K), sodium (Na), calcium (Ca), iron (Fe), magnesium (Mg) in different proportions. These findings ascribed to cucumber a reservoir of medicinally important constituents, better energy source, inhibitors and activators of biological processes.

Key words: Anti-nutrients, Cucumber, Mineral elements, Phyto-constituents

INTRODUCTION

There exist a vast array of biologically-active constituents in plants that potentiate danger to human and other animals.The awearness that these compounds have the ability to exert toxic and biological responses when ingested has called for urgent investigation, with a view to ascertain their activities in the biological systems (Igile, 1996). Natural substances of plant origin such as alkaloid, saponnins, tannins, oxalic acid, flavonoids, trypsin (protease), oxalates, phytates, haemagluttinins (lectins), cyanogenic glycosides, coumarins and gossypol have been proven active with enormous ability to elicit biological responses (Zenk, 1991). These molecules are responsible for whatever changes that occur biochemically, when these plant derivatives are ingested. Some of these metabolites are endowed with chelating ability. Tannins for example, a well-known antinutritional factor, water soluble phenolic compounds with a molecular weight greater than 500, with ability to precipitate proteins from aqueous solution by forming complexes and rendering them unavailable for digestion (Binta and Khetarpaul, 1997). The binding affinities of these bio-chemicals to divalent elements that are of physiologically importance form the basis of various metabolic disorders and malfunctions of the vital organs *in vivo*; Oxalate binds to calcium to form

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calcium oxalate crystals and equally impair the absorption and utilization of calcium in the body resulting to disease conditions; ricket and Osteomalacia and renal stones (Ladeji *et al.,* 2004).

Aletor and Adeogun (1995) reported that some anti-nutritonal phytochemicals exhibit protective effects, thus making them to serve a dual purposes of reducing some essential nutrients and protecting the body against a number of biochemical, Physiological and metabolic disorders. The bio-unavailability of most mineral elements mediated by antinutrients *in vivo* has already been established by Akindahunsi and Slawu (2005). Thus, antinutrients are natural or synthetic compounds that interfere with the absorption of nutrients (Oxford dictionary of Biochemical and molecular biology, 2006).

MATERIAL AND METHODS

Chemicals

Chemicals and reagents procured for this work were all of analytical grades.

Sample Collection and Authentication

Fresh cucumber fruits were obtained from Anyigba central market, Anyigba, Kogi State, Nigeria and were authenticated by Dr. D. O Aina, in the Department of Biological Sciences of the same Institution. A voucher specimen of the sample was deposited.

Sample Preparation

The fruits (cucumbers) were washed with clean water, open-air-dried under the shade. 50g of the dried samples were macerated with mortal and pestle. The pulverised samples were used for proximate analysis and screening of antinutrients, phytochemicals and mineral elements.

Phytochemicals and Anti-nutrients Screening

Qualitative and Quantitative Determinations

The procedures of Harborne (1998), Sofowora (1991) and El-Olemyl *et al.,* (1994) were employed in the qualitative and quantitative screening of saponins, alkaloids, tannins, flavonoids, cyanogenic glycosides and phenolic compounds.

A procedure described by Lucas and Markakas (1975) was used for phytate determination. Oxalate test was carried out using a reported procedure described by Fasset (1996).

Mineral analysis

Fe, Mg, Zn, Ca in plant samples were analyzed using atomic absorption spectrophotometer (AA 6300, Shimadzo, Japan) equipped with flame and graphite furnace. Potassium and sodium were determined by Flame photometer, as described by Egan *et al*., (1981) and AOAC (1990). Phosphorous was estimated spectrophotometrically using phospho-vanadomolybdate method.

Proximate composition estimation

Moisture content, ash and crude fibre determination were carried out by the outlined laboratories procedure for food analysis (AOAC, 2007). Fat estimation was done by soxhlet extraction method. Kjeldahl method was used for protein determination. Carbohydrate estimation was done by a modified method described by Ayoola *et al*., (2012).

RESULTS AND DISCUSSION

Table 1 showed the presence of phyto-constituents in the sample investigated. Saponnins, tannins, alkanoids, cyanogenic glycosides, alkaloids, phytic and oxalic acids, flavonoids, phenolic compounds detected are essentially anti-nutritional compounds of biological importance, that are thought to be responsible for the acclaimed phenomenal exhibited by this sample.

Table-1. Anti-nutrients and phyto constituents of the dried–weight of cucumber fruit

S/No	Parameters	Inference
A	Saponins	+
B	Tanins	+
C	Flavonoids	+
D	Oxalic acids	+
E	Phytic acids	+
F	Cyanogenic glycosides	+
G	Alkaloids	+
H	Phenolic compound	++

Key: + Present
++ Present in high amount.

Table-2. Quantitative anti-nutrients and phyto constituents of the dried weight of cucumber fruit.

S/No	Parameters	Compositions
A	Saponins	0.64 mg/g 0.64 mg/g
B	Tanins	0.33 mg/g
C	Flavonoids	3.18 mg/g
D	Oxalic acid	0.01mg/g
E	Phytic acid	0.88%
F	Cyanogenic glycosides	0.30mg/g
G	Alkaloids	3.00%
H	Phenolic compound	1558.98 mg/g

Table-3, revealed the results of the analysis of proximate composition of the dried weight of Cucumber fruit (*Cucumis sativus*), protein (17.41%), moisture content (12.6 %), ash residue (2.70%), fat component (4.8%), carbohydrate (56.83%) and crude fibre (5.66%). High carbohydrate and protein compositions in the sample may explain the energy storage mode in relation to the fat component. The moisture contents, ash and crude fibre could probably suggest the amount of water contents, minerals and nutritive index of the sample.

Table-3: Proximate composition of the dried weight of cucumber fruit

S/No	Parameters	Value (%)
A	Protein	17.41
B	Moisture	12.60
C	Ash	2.70
D	Fat	4.80
E	Carbohydrate	56.83
F	Crude fibre	5.66

Table-4: Mineral compositions of the dried- weight of cucumber fruit.

S/No	Mineral element	Ppm (parts per million)
A	Calcium (ca)	178.11
B	Sodium (na)	60.78
C	iron (fe)	3.40
D	Phosphorus (p)	20.33
E	Potassium (k)	200.01
F	Magnesium (mg)	60.00

Table-4 showed the mineral constituents of the analysed sample (Cucumber). Ca, Na, Fe, P, K Mg detected in different proportions are vital to the biological activity of the sample investigated.

Discussion

The results presented in the tables above, revealed the presences of saponins, flavonoids, tannins, alkaloids, cyanogenic glycosides and phenolic compounds, and other anti-nutrients such as phytates and oxalates which are collectively refered to as secondary metabolites. The results of this analysis also showed the presence of carbohydrates, proteins, fats, and crude fibre, moisture and ash contents. The phytochemicals detected may in many ways contribute to the medicinal uses of this fruit and the overall plant (cucumber). Phytochemicals have been previously reported to have some medicinal ingredients which supports its usage (Godwin and Mercer, 1993; Tella *et al.*, 2005), and other endogenous compounds found in company of these phyto-constituents (phytates and oxalates acids) are the major factors responsible for the dual nature in terms of medicinal value, toxicity and anti-nutritional characteristics.

The high carbohydrates and proteins contents in the fruit probably contributes to its energy value. High carbohydrate levels of this sample points to the likely storage pattern of energy in the form of starch rather than fat, revealed in the amount. The amount of fiber contents in the sample tally with the reported evidence postulated earlier by Usha *et al*., (1989) and Vinik and Jenkins (1998) at different time, on the use of crude fibre in the management of diabetes. Protein an essential macromolecule in immune system formation and boost, repair and maintenance of the worn-out tissues (Santyanarayana and Chakrapani, 2007), was also implicated and confirmed present in this investigation. The presence of ash in the sample could suggest a viable source of nutrients (Reebe *et al*., 2000) and moisture content might be indicative of high water contents reserved for the various metabolism, regarding fruit development and maturation. Mineral elements such as potassium (K) , sodium (Na), calcium (Ca), phosphorus (P), iron(Fe) and magnesium (Mg) were elucidated judging from the data obtained from the experimental analysis. Ca, Mg and P are important for bone formation and its maintenance (Tolonen, 1990). High K concentration, with low Na level being intracellular and extracellular cations of importance, might be due to the specific functions they are playing in cellular metabolism, modulation and signaling (Santyanarayana and Chakrapani, 2006).

Single meal studies and short term dietary intervention studies have shown that there is a strong absorption depression effect of calcium on iron's absorption (Hallberg *et al.*, 1991). A high dietary intake of manganese has been demonstrated experimentally to inhibit the ultilization and uptake of iron and other chemically related elements (Mena *et al*., 1969). It is probable that low level of iron (Fe) in this sample is as a result of high amount of manganese *in vitro* (though not screened for). Animal model experiment, has linked the negative interaction between mineral elements and the corresponding anti-nutritional factors in terms of absorption and bio-availability, and has been demonstrated through zinc impair absorption in the presence of phytate and calcium and there likely co-precipitation with phytate and zinc (Oberleas *et al.*, 1966). Thus, decreased iron absorption in cereals and leafy vegetables by phytic and oxalic acids and conversely, with concomitant decrease in iron absorption by calcium via mineral- nutrient and mineral-mineral interactions have been documented in the literature (Vasudevan, 2008).

Conclusion

In view of the evidence obtained from the various components of the sample (cucumber fruit) analysed, it's obvious that cucumber harbor potentially numerous substances that are beneficial nutritionally to human. The anti-nutrient components have been determined, documented and formed the underlying principle of nutrients interaction in the biological system. Onward studies on the mode(s) of action by which each of this plant metabolite excerpt their influences on biological system are recommended, henceforth.

Conflict of Interests

Authors declare that there is no conflict of interests regarding the publication of this paper.

References

[1]. Akindahunsi, A. A and Salawu, S. O. (2005). Phytochemical screening of Nutrients and Anti nutrients Composition of Selection. Tropical Green Leafy Vegetables. *African Journal of Biotechnology*. **4**(6):497-501.

[2]. Aletor, V. A and Adeogun, O. A. (1995). Nutrients and Anti-nutrient component of same Tropical Leafy Vegetable. *Food chemistry*. **54** (4): 375-379.

[3]. Association of Official Analytical Chemists (A.O.A.C). (1990). Official analysis (15th edition). Washington D.C. Pp: 34-61.

[4]. Association of official analytical chemist, (2007). Official methods of analysis 18th edition Washington D.C. Pp: 774-783.

[5]. Ayoola, P. B., Adeyeye, A., Adelowo, F; Onawumi, O. O. (2012). Evaluation of the Chemical and Nutritional Values of Some Nigerian Watermelon (*Citrullus lanatus*). *Journal of Laboratory Science*. Volume 1, number 1; Pp 37 – 41.

[6]. Binta, R and Khetarpaul, N. (1997). Probiotic Fermentation: Effect on Anti-nutrients and Digestability of Starch and Protein of Indigenous Developed Food Mixture. *Journal of Nutritional Health*, Pp: 139-147.

[7]. Egan, H., Kirk, R.S. and Sawyer, R. (1981). Pearson's Chemical Analysis of Foods. 8th Edition. Churchill, Livingstone, New York.

[8]. El-Olemyl, M. M., Al-Muhtadi, F. J and A. A. Afifi, (1994): Experimental Phytochemistry, A Laboratory Manual. King Saud University Press., UK., Pp:1-134.

[9]. Fasset, D. W. (1996). Oxalate. In: Toxicants occurring Naturally in Foods. National Academy of Science Research Council, Washington D. C. U.S.A.

[10]. Godwin, T. W. and Mercer, E. I. (1993): Introduction to Plant Biochemistry, 2nd edition. Pergamon Press Oxford, Pp: 400-480.

[11]. Hallberg L., Brune M., Erlandsson M., Sandberg A-S & Rossander- Hulten, L. (1991). Calcium: Effect of different amounts on nonheme- and heme-iron absorption in humans. *American Journal of Clinical Nutrition* **53**: 112-119.

[12]. Harbone, J.B. (1998): Phytochemcial methods A Guide to modern Technique of plant analysis, 3rd edition Chapman and Hill London, Pp:185-189.

[13]. Harborne, J.B. (1973). Phytochemical methods. A guide to Modern Techniques of Plant Analysis 2nd edition. Chapman and Hall London P: 1.

[14]. Igile G.O. (1996). Phytochemical and Biological Studies on some constituents of *Vernoni amygdalina* (*Compositae*) Leaves. Ph.D Thesis. Department of Biochemistry, University of Ibadan, Nigeria.

[15]. Ladeji, O., Akin, C.U and Umaru, H. A. (2004). Level of Anti-nutrientional Factors in Vegetables commonly eaten in Nigeria. *African Journal of Natural Sciences* **7**:71-73.

[16]. Lucas, G.M. and Markakas, P. (1975). Phytic acid and other Phosphorus Compounds of Bean (*Phaseolus vulgaris*). *Journal of agricultural Edu chem.* **23**: 13-15.

[17]. Mena, I., Horiuchi, K., Burke, K and Cotzias, G. C. (1969). Chronic Manganese Poisoning. Individual susceptibility and Absorption of Iron. Neurology, **19**: 1000- 1006.

[18]. Nnam, N. M and Onyeke N.G (2003). Chemical Composition of two varieties of Sorrel (*Hisbiscus sabdariffa L*.), calyces and the drinks made from them. Plant Foods for Human Nutrition. **58**: 1-7.

[19]. Oberleas, D., Muhrer, M .E and O'Dell, B. L. (1966). Dietary Metal- Complexing Agents and zinc availability in the Rat. Journal of Nutrition, **90**:56-62.

[20]. Oxford Dictionary of Biochemistry and molecular Biology. (2006). Oxford University Press. P:962.

[21]. Reebe, S., Gonzalez, V. N and Rengifo J. (2000). Research on Trace Elements in common Beans. *Food Nutrition Bulletin*. **21:** 387-391.

[22]. Santyanarayana, U. and Chakrapani, U. (2007). Medical Biochemistry. 3rd Edition, Arunabaha Sen. Book and Alied Publisher Ltd. Revised Edition. Pp: 182-419.

[23]. Sofowora, A. (1991): Medicinal Plants and Traditional Medicine. John Wiley and Sons. Pp: 66- 79.

[24]. Tella, I.O. and Ojo O.O., Ademola-Aremu, O.O. (2005): Hepatoprotective Effects of *Azadirachta Indica*, Tamarindus Indica and *Eucalyptus camaldulensis* on paracetamol induced-hepatotoxicity in rats *J. sustain Deve. Agric. Envin*. Vol. **1**:437-439.

[25]. Tolonen M. (1990). Vitamins and Minerals in Health and Nutrition. Ellis Horwood Ltd., England. Pp: 45-68.

[26]. Usha, V., Vijayamma, P.L., Kurups P. A. (1989). Effects of Dietary Fibre from Banana (*Musa paradisiaka*) on Metabolism of Carbohydrates in Rats Fed Cholesterol Free Diet. Indian J. *Experimental Biology*. **27**(5):445-449.

[27]. Vasudevan, D.M. (2008). Jaypee Gold Standard Mini Atlas series Biochemistry for Medical Students, 6th Edition. P: 308.

[28]. Vinik, A. I., Jenkins D. J. (1998). Dietary Fibre in Management of Diabetes. Diabetes Care. **11**(2):160-173.

[29]. Zenk, H. M. (1991).Chasing the Enzymes of Secondary Metabolism: Plant Cell Cultures as a Pot of Goal. *Phytochemistry*, 30(12), Pp:3861-3863. Zess NaukUMK Tomu, **13**:253-256.

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