International Journal of Nutrition and Food Sciences
2014; 3(6): 493-496
Published online October 30, 2014 (http://www.sciencepublishinggroup.com/j/ijnfs)
doi: 10.11648/j.ijnfs.20140306.11
ISSN: 2327-2694 (Print); ISSN:2327-2716 (Online)

Evaluation of tannin, phytate and mineral composition of different indigenous dishes based on pumpkin (*Cucurbita pepo)*

Obiakor-Okeke Philomena Ngozi, Oly-Alawuba Nkiru

Department of Nutrition and Dietetics, Faculty of Health Science Imo State University, Owerri, Imo State, Nigeria

Email address:
ngoziobiakor2001@yahoo.com(Obiakor-Okeke P. N.), enkayoly@yahoo.com (Oly-Alawuba N.)

To cite this article:
Obiakor-Okeke Philomena Ngozi, Oly-Alawuba Nkiru. Evaluation of Tannin, Phytate and Mineral Composition of Different Indigenous Dishes Based on Pumpkin (*Cucurbita Pepo)*. *International Journal of Nutrition and Food Sciences.* Vol. 3, No. 6, 2014, pp. 493-496.
doi: 10.11648/j.ijnfs.20140306.11

Abstract: Introduction: The study evaluated the tannin, phytate and composition of different indigenous dishes based on pumpkin (*Cucurbita pepo*). Methodology: The samples used in the study include raw seeds, uncooked pulp, leaves, roasted seeds and cooked pulp were prepared for analysis and also different native meals were prepared using leaves for soup, pulp for pottage yam and seeds for snacks. The tannin, phytate and mineral analysis were determined following standard methods. The mean and standard deviation of triplicate samples were determined. Result: The results of the analysis showed that the raw seed sample have about 0.26% tannin and 0.17% in roasted seeds. The leaves have (0.06%) of tannin which is lower compared to (0.75% and 0.12%) in uncooked pulp and cooked pulp respectively. Phytate is found (0.37%) in raw seeds, it is higher compared to (0.07%) in leaves. Roasted seeds have (0.08%) and (0.16%) in uncooked pulp. No phytate was dictated in cooked pulp. The mineral analysis revealed that phosphorus is more found in the leaves with (0.36%) compared with the amount in uncooked and cooked pulp (0.21% and 0.18%). Zinc is found more in leaves also with (5.81%) and raw seeds (4.55%), while the amount of zinc in uncooked pulp (3.73%) and roasted seed (3.16%) are in close range. The cooked pulp has the lowest value (2.60%). The leaves have higher copper content (3.67%). The raw seeds (2.41%) and uncooked seeds have close related values (0.76% and 1.41%) respectively. Conclusion: The result of this study showed that pumpkin contained antinutrients and it is also a good source of minerals. However, different processing methods reduced antinutrient content in the different edible parts and increased the different mineral composition. We therefore, recommend proper processing before consumption of any of the parts so that the absorption and utilization of the minerals will be maximized.

Keywords: Tannin, Phytate, Minerals Indigenous Dishes, Pumpkin (*Cucurbita pepo*)

1. Introduction

Cucurbita pepo is a cultivated plant of the genus Cucurbita. It yields varieties of winter squash and pumpkin, both a shrubby and creeping plant, obovoid or conical shape, pointed at the apex and with longitudinal grooves, thus resembling a spinning top(1 -2). The mature or young fruit and the seeds of C. pepo, as well as to a lesser extent the flowers and young tips of the stems, are eaten in many parts of its native distribution area and in other regions of the world (3). In Nigeria, the different parts of *Cucurbita pepo* are edible: the pulp, seed and leaves. They are used to prepare different types of dishes.

Cucurbita pepo, one of the varieties of pumpkin, is one of the most common pumpkins in the eastern part of Nigeria (mostly in Imo, Abia and Anambara states). Its indigeneous name in igbo land is "ugboguru". It is used in preparing some local dishes like soup, pottage yam and in making sauce. The use in soup making, the leaves are used to prepare "Ugboguru soup", while in making pottage yam, the pulp is scooped out after boiling for about 10 – 15 minutes. The pulp can also be used as a sauce when it is scooped out after boiling and mixed with red oil, salt, pepper and pounded onion. These mixtures can be used in eating boiled yam. It can also be eaten like that without boiled yam. However, it is important to note that in different part of igbo land as well as in Nigeria, the preparation method might differ and some even do not make use of the leaves at all.

Phytic acid which is also known as

inositolhexakisphosphate (IP6), inositol polyphosphate, or phytate when in salt form, according to history was discovered in 1903. It is a saturated cyclic acid, and it is the principal form that phosphorus is stores in plant tissues. Studies have shown that phytate cannot be digested by humans or non-ruminant animals, so it is not a source of either inositol or phosphate if eaten directly. Hence research evidence has shown that phytic acid chelates and thus makes unabsorbable certain important minor minerals such as zinc and iron, and to a lesser extent, also macro minerals such as calcium and magnesium; phytin interfers specifically with calcium or magnesium salt. It is important to note here that food preparation techniques can break down the phytic acid in foods. Simply cooking the food will reduce the phytic acid to some degree. More effective methods are soaking in an acid medium, lactic acid fermentation, and sprouting (4 - 6).

Another important antinutrient is tannin. This is an astringent, bitter plant polyphenolic compound that binds to and precipitates proteins and various other organic compounds including amino acids and alkaloids. The tannin compounds are widely distributed in many species of plants, where they have been attributed to play a role in protection from predation, and perhaps also as pesticides, and in plant growth regulation. Tannins have traditionally been considered antinutritional but it is now known that their beneficial or antinutritional properties depend upon their chemical structure and dosage (7 - 8).

Antinutrients are natural or synthetic compounds that interfere with the absorption of nutrients (9). Phytic acid (phytate) which is one of the antinutrients we are considering in this study has a strong binding affinity to minerals such as calcium, magnesium, iron, copper, and zinc. They result in precipitation, making the minerals unavailable for absorption in the intestines (9 -10). Another particularly widespread form of antinutrient we are considering is tannins. It is one of the flavonoids, which are a group of polyphenolic compounds. These compounds chelate metals such as iron and zinc and reduce the absorption of these nutrients, but they also inhibit digestive enzymes and may also precipitate proteins (11).

The main problem in nutritional exploitation of green leafy vegetable is the presence of anti-nutrients and toxic principles. These factors are usually present in trace amount but they do have profound effects on the nutritional potential of the vegetables. The presence of anti-nutritional components, such as phytic and oxalic acid in green leafy vegetables has impairment on the efficient utilization of calcium and magnesium by formation of indigestible complexes with the mineral elements. Saponin and tannin are other anti-nutritional components of interest in vegetable studies (12).

Pumpkin is among the underutilized vegetables in Nigeria of which the health benefit of its various parts is well documented in various literatures (13 - 15). However, vegetables are good sources of micronutrients (minerals), hence considering tannin and phytate composition of different indigenous dishes based on pumpkin(Cucurbita pepo) is an important study that will help us understand the best method that will reduce these antinutrients and its effect.

2. Materials and Methods

The pumpkin pulp, seed and leaves were purchased from Ogwumabiri Obizi market in Ezinihitte Mbaise Local Government Area of Imo State.

2.1. Preparation of Samples

The pulp was sliced open, the seeds were brought out. The flesh was scooped out and cut into tiny piece and kept in a covered container. The leaves were cut into tiny pieces and stored also in a container. The seeds were ground in a manual grinder without drying. The roasted seeds were also ground in a different container covered air tight. The same was done for the cooked flesh from the pulp. All the samples were kept in desiccators to preserve it from being contaminated.

2.1.1. Preparation of Indigenous Dishes Using Pumpkin Leaves, Pulp and Seeds

The dishes to prepare are:

1. Pumpkin Roasted Seeds

2.1.2. Roasted Seeds

Ingredients

Salt only

2.2. Method

1. Bring out the seeds from the pulp
2. Rinse them in water
3. Apply and rob salt on them
4. Allow for some time to absorb the salt, this is to give the seeds taste
5. Put the seeds on frying pot and begin to turn them
6. The heat temperature should be moderate to avoid boring of the seeds. When done put down the frying pot.

2.3. Determination of Tannin

7. The Folin-Denis spectrophotometric method was used. The method was described by Pearson (17). A measured weight of each sample (1.0g) was dispersed in 10ml distilled water for 30 minutes at room temperature, being shaken every 5 minutes. At the end of the 30 minutes, it was centrifuged and the extract gotten. The supernatant 2.5ml (extracts) was disposed into a 50ml volumetric flask. Similarly, 2.5ml of standard tannic acid solution was disposed into a separate 50ml flask. A 1.0ml Folin-Denis reagent was measured into each flask, followed by 2.5ml of saturated Na2CO3 solution. The mixture was diluted to mark in the flask (50ml) and incubated for 90 minutes at room temperature. The absorbencies were measured at 250mn in a Genway model 6000i electronic spectrophotometer. Readings were taken with the reagent blank at zero. The tannin content was given as follows:

$$\% \text{ Tannin} = \frac{An}{As} \times \frac{C}{W} \times 100 \times \frac{Vf}{VA}$$

Where:

An = Absorbance of test sample
As = Absorbance of standard solution
C = Concentration of standard solution
W = Weight of sample used
Vf = Total volume of extract
Va = Volume of extract used in the assay

2.4. Phytic Acid (Phytate) Determination

This was determined using the method described by AOAC(16). The sample was first extracted with 0.2N HCl, 0.5m of the extract solution was pipette into a test-tube filtered with a ground glass stopper. 1ml teric solution was added and the tube was covered well. The tube was later heated in a boiling water bath for 30 minutes.Afterheating, the tube was cooled in ice water for 15 minutes and allowed to adjust to room temperature. The tube was then mixed and centrifuged for 30 minutes at 3000rpm. 1ml of the supernatant was transferred to another tube and 1.5ml of 2,2, Bipyridin solution and the absorbance was measured at 50mn against distilled water.

2.5. Calculation

Phytic Acid

(mg/s)=(Vf/Vx X 100/w X 1/100)x

Where:

Vf = Total volume of extract
Vx = Volume of extract used
W = Weight of sample used

2.6. Data Analysis

The data collected was analyzed using SPSS version 15.0 software. Descriptive statistics was determined to tabulate the mean and standard deviation of triplicate samples.

2.7. Result and Discussion

Table 1. *Anti-Nutrients*

Sample	Tannin	Phytate
Raw Seeds	0.25 ± 0.0100	0.36 ± 0.0158
Roasted Seeds	0.17 ± 0.0100	0.08 ± 0.0158
Leaves	0.06 ± 0.0158	0.08 ± 0.0100
Cooked Pulp	0.11 ± 0.0158	-
Uncooked Pulp	0.76 ± 0.0100	0.16 ± 0.0100

Mean ± Standard Deviation of three replications

Table 1 presents the anti-nutrients of pumpkin leaves, pulps and leaves.

The raw seed sample have about 0.26% tannin and 0.175% in roasted seeds. The leaves have (0.06%) of tannin which is lower compared to (0.75% and 0.12%) in uncooked pulp and cooked pulp respectively. The decrease in value of tannin in the cooked pulp and roasted seeds is as a result of the cooking and roasting methods used (18 - 19). Cooking has been an effective way of reducing antinutrients from foods as well as other processing methods like fermentation and germination of seed (6 -8).According to Ene-Obong(20), tannin protein complexes are responsible for growth depression, low protein digestibility, decrease amino acid availability.

Phytate is found (0.37%) in raw seeds, it is higher compared to (0.07%) in leaves. Roasted seeds have (0.08%) and (0.16%) in uncooked pulp. Reduction in phytate disappearances in roasted seed and cooked pulp is as used (19). According to Onimawo and Akubor (19), phytic acid form insoluble salts. With metals e.g. iron and zinc which render the metal unavailable for absorption into the body, phytates effect digestibility by chelating with calcium or proteolytic enzymes.

Table 2. *Mineral Composition*

Sample	Phosphorus (%)	Zinc (%)	Copper (%)	Iron (%)
Raw Seed	0.32±0.01	4.55±0.010	2.41±0.012	5.05±0.013
Roasted Seed	0.28±0.01	3.16±0.001	2.15±0.011	4.85±0.001
Leaves	0.36±0.01	5.81±0.010	3.67±0.015	5.10±0.011
Cooked Pulp	0.00±0.00	3.73±0.001	0.76±0.001	4.62±0.010
Uncooked Pulp	0.00±0.00	2.60±0.010	1.46±0.010	3.80±0.012

2.8. Minerals

In table 2, it is shown that phosphorus are more found in the leaves with (0.36%) both roasted and raw seeds have (0.28% and 0.32%) compared with the amount in uncooked and cooked pulp (0.21% and 0.18%). Zinc is found more in leaves also with (5.81%) and raw seeds (4.55%), while the amount of zinc in uncooked pulp (3.73%) and roasted seed (3.16%) are in close range. The cooked pulp has the lowest value (2.60%). The presence of zinc in pumpkin boosts the immune system and also improves the bone density (21). The leaves have higher copper content (3.67%). The next is raw seeds (2.41%) and uncooked seeds have close related values (0.76% and 1.41%) respectively. The pulp has the lowest concentration of iron, having 3.80% and 4.62% for cooked and uncooked pulps respectively. A similar study on the seed extracts revealed an Iron content of 3.75±0.02mg/100g (22) Iron plays a vital function in the formation of blood, it also aids in the transfer of oxygen and carbon dioxide from one tissue to another (23). Iron deficiency precipitates anaemia which impairs muscles metabolism and in children results in impaired learning ability and behavioural problems (24).

The study by Elinge et al showed that Pumpkin seed presented high value for Zinc (14.14±0.02mg/100g), this is quite higher than the result of this study (22). Zinc to play a role in the proper functioning of some sense organs such as ability to tastes, sense and smell, it also boost the health of our hair (25). Zinc plays a very vitalfunction in protein and carbohydrate metabolism and as well aid in the mobilization of vitamin A from its storage site in the liver and facilitates the synthesis of DNA and RNA necessary for cell production (22).

The concentration of minerals in this study revealed that this vegetable and the pulp as well as the seed are rich source of micronutrients like many other vegetables(22 -24). However, presence of antinutrients can render these minerals unavailable for absorption by the body. This study have shown that the processing methods adopted reduce the presence of phytate and tannin to a safe level to make these minerals available for human consumption.

3. Conclusion

This work has provided baseline information on the tannin, phytate and mineral profile pumpkin leaves, pulps and seeds. In other to absorb all the bio-available nutrients, pumpkin pulp, leaves or seeds should be boiled or roasted to remove the anti-nutritional factors that might hinder utilization.

References

[1] Paris, H. S.; Yonash, N.; Portnoy, V.; Mozes-Daube, N.; Tzuri, G.; Katzir, N. (2003). "Assessment of Genetic Relationships in Cucurbitapepo (Cucurbitaceae) Using DNA Markers". Theor. Appl. Genet.106 (6): 971–978. doi:10.1007/s00122-002-1157-0. PMID12671744.

[2] Paris, Harry S. (1986). "A Proposed Subspecific Classification for Cucurbita pepo". Phytologia (Bronx Park) 61 (3): 133–138.

[3] Jeffrey, C. (1978). Further notes on Cucurbitaceae. IV. Some New World taxa. Kew Bull., 33: 347-380.

[4] Mullaney, Edward J.; Ullah, Abul H.J. (2012) "Phytases: attributes, catalytic mechanisms, and applications". United States Department of Agriculture–Agricultural Research Service. Retrieved May 18, 2012.

[5] Forbes, RM; Parker, HM; Erdman JW, Jr (1984). "Effects of dietary phytate, calcium and magnesium levels on zinc bioavailability to rats.".The Journal of nutrition 114 (8): 1421–5.

[6] Klopfenstein, Terry J.; Angel, Rosalina; Cromwell, Gary; Erickson, Galen E.; Fox, Danny G.; Parsons, Carl; Satter, Larry D.; Sutton, Alan L.; Baker, David H. (2002). "Animal Diet Modification to Decrease the Potential for Nitrogen and Phosphorus Pollution".Council for Agricultural Science and Technology 21.

[7] Katie E. Ferrell; Thorington, Richard W. (2006). Squirrels: the animal answer guide. Baltimore: Johns Hopkins University Press. p. 91. ISBN 0-8018-8402-0.

[8] McGee, Harold (2004). On food and cooking: the science and lore of the kitchen. New York: Scribner. p. 714. ISBN 0-684-80001-2

[9] Ekholm, Päivi; PäiviEkholm; LiisaVirkki; MaijaYlinen; Liisa Johansson (2003). "The effect of phytic acid and some natural chelating agents on the solubility of mineral elements in oat bran". Food Chemistry80 (2): 165–70. doi:10.1016/S0308-8146(02)00249-2.

[10] Cheryan, Munir; Rackis, Joseph (1980). "Phytic acid interactions in food systems". Crit Rev Food SciNutr13 (4): 297–335. doi:10.1080/10408398009527293. PMID 7002470

[11] Beecher GR (2003). "Overview of dietary flavonoids: nomenclature, occurrence and intake". J. Nutr.133 (10): 3248S–54S. PMID 14519822.

[12] Messina M. & Messina V. (1999) :A contributingpaper to cancer resource foundation bulletin,U.S.A 1999 Feb 1;59(3):602-6. (URL//httpwww.google.com)

[13] Hata K, Tanahashi S, Wakida Y, Tatsuzaki M, Koide A. (2005) Effect of Pumpkin seed extract on urinary bladder function inanesthetized rats. Jpn J Med Pharm Sci. 2005;54(3):339-45.

[14] Sogabe H, Terado T. (2001) Open clinical study of effects of pumpkin seed extract/soybean germ extract mixture containingprocessed foods on nocturia. Jpn J Med Pharm Sci. 2001;46(5):727-37.

[15] Terado, T et al. (2004) Clinical study of mixed processed food containing pumpkin seed extract and soybean germ extract onpollakiuria in night in elderly men. Jpn J Med Pharm Sci. 2004;52(4):551-61.

[16] A.O.A.C (1990): Official method of analysis, 5th edition, Sidney Williams (ed.), Association of Official Analytical Chemists Inc, Arlington.

[17] Pearson D (1991): Pearson's composition and analysis of foods. Co. Published in the United States with John Wiley and Sons Inc., New York.

[18] Hajos G and Osagie A.U (2004): The impact of dehydration process on anti-nutrients and protein digestibility of some vegetables.

[19] Onimawo, I.A. and Akubor, P.I. (2005). Functional properties of food. In: Food Chemistry.Integrated Approach with Biochemical Background. Ambik Press Limited, Benin City, Nigeria.Pp 208-221

[20] Ene-Obong (2001): Eating right: A Nutrition Guide. The University of Calabar Press, Calabar

[21] George R.A.T (1999): Vegetable seed production. Longman, London.

[22] Elinge C. M., Muhammad A., Atiku F. A., Itodo A. U., Peni I. J., Sanni O. M., Mbongo A. N. (2012) Proximate, Mineral and Anti-nutrient Composition of Pumpkin (Cucurbitapepo L) Seeds Extract International Journal of Plant Research p-ISSN: 2163-2596 e-ISSN: 2163-260X 2012; 2(5): 146-150 doi:10.5923/j.plant.20120205.02

[23] Guthrie, H. A. (1989). Introductory Nutrition (7th ed.). Time mirror Mosby college publishers, Boston.

[24] McDonald, A., Edwards, R. A., Greenhulgh, F. D. and Morgan, C. A.(1995). Animal Nutriton.Prentices Hall, London Pp101-122.

[25] Payne, W. J. A. (1990). An Introduction to Animal Husbandry in the Trophics. Longman Publishers Singapore Pp 92-110.

[26] Michael, Orsolek D, George L (2000): "Pumpkin Production". Agricultural Alternatives.

[27] NgwemmeChiegumira (2000): Plant resources of tropical Africa. Backhuy's Publishers, Netherland.

[28] Oke O.L (2000): Chemical studies on some Nigerian vegetables. Trop. Science, Vill. Pp. 20 – 25.