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Nutritional Composition of Some Accessions of Pumpkin (Cucurbita Spp) Seeds from Abia State, Nigeria

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Abstract:
Despite the nutritional and positive health benefits of consuming pumpkin seeds, pumpkin is still one of the underutilized crops and its existence in Nigeria especially in Abia State, is presently threatened due to neglect. The study involves evaluation of seeds of some accessions of pumpkin for proximate, mineral, vitamins and phytochemical composition. Proximate composition indicated that moisture content (5.77- 9.18%), ash (3.47–4.26%), crude fibre (1.62-1.95%), ether extract (23.23–28.56%), and dry matter contents (90–94.23%) differed significantly ($p<0.05$) among the seeds while carbohydrate (CHO - 0.57–0.90%) and protein (17.19–32.07%) did not. Minerals varied significantly among the pumpkin seeds and potassium (216.69 - 263.66 mg/100 g) is the most abundant followed by sodium (149.58-170.66 mg/100g), and then Magnesium (63.64-75.87 mg/100g) while the least is iron (2.62-3.61 mg/100g). In the analysis of vitamins, thiamin (0.04-0.08 mg/100g), vitamin A (0.19-0.44 mg/100 g), vitamin C (0.31-0.77 mg/100g) and Vitamin E (1.19-1.48 mg/100g) were significantly different among pumpkin seeds while riboflavin (0.02-0.04 mg/100g) and niacin (0.05-0.51 mg/100g) were not. The phytochemical compositions were: Alkaloid (0.04-0.67%), tannin (0.04-0.34%), oxalate (0.04-0.06%), saponin (0.05-0.09%), hydrogen cyanide (HCN - 0.30-0.73%) and phytate (0.20-0.44%). The values are very low and varied significantly among the seeds except tannin. It can be concluded that pumpkin seeds are good source of some minerals, protein and oil. Thus, more attention should be given to the cultivation and utilization of pumpkin seeds.

Keywords: *Pumpkin seeds, proximate, mineral, vitamins and phytochemical composition*

1. Introduction

Pumpkin is an important member of the *Cucurbitaceae* family and is among the 10 leading vegetable fruit crops worldwide, being extensively grown in temperate and subtropical regions of the world (Tadmor et al. 2005). It is a vine crop and plays an important role in the traditional setting as a cover crop and weed control agent (Delahaut and Newenhouse, 2006). Pumpkin is regarded as a poor man's food and cultivated mainly for its fruits and leaves. Seeds are thrown away as waste or preserved for the next planting material. Pumpkin seeds are richly endowed in proteins, lipids, macro elements - magnesium, phosphorus, calcium, and moderate amounts of micro elements - calcium, manganese, copper and zinc (Raphael et al., 2014 and Nwofia, et al., 2012) and thus the seed could be used as a valuable food supplement that could greatly contribute to human nutritional requirements.

The seed provides good quality oil mainly consisting of unsaturated fatty acids and excellent source of fibre (Karanja et al., 2013 and Karanja et al., 2014). Okoli and Okoronkwo (2020) revealed that the development of highly nutritious crops will improve the nutritional status of the region and generally the standard of living of farmers in Southeastern Nigeria.

Pumpkin is one of the underutilized crops, its existence is presently being threatened due to neglect in Nigeria especially in Abia State. Pumpkin is cultivated in Abia in a subsistence level with virtually no commercial importance. Many of the populace is unaware of the high nutritional and nutraceutical values of pumpkin seeds, thus has not benefited from the same level of research attention given to other vegetable crops like cucumber, fluted pumpkin, melon, etc. (Aruah *et al*., 2011).

There is need to arouse interest in its utilization beyond the traditional localities, by enlightening Abians and Nigerians at large on nutritive value of pumpkin seeds which will help encouraged high income earners and urban dwellers from making this crop part of their diet. Hence, this study was designed to evaluate the proximate, mineral, vitamins and phytochemical composition of some accessions of pumpkin seeds from selected areas of Abia State. The information got from this research will aid the plant breeders in improvement of pumpkin, also help to address the current global food security problems since the crop grows and yield well even with very little attention and management.

2. Materials and Methods

2.1. Sources of Sample

The experimental materials comprised of 12 accessions of pumpkin seeds collected from different locations in Abia State, Nigeria (Table: 1).

2.2. Sample Preparation

The pods were washed with distilled water, cut and the seeds extracted, cleaned using filter paper and air-dried at room temperature. The dried seeds were ground to flour using a grinder, the flour was then packed in a clean dry plastic container, sealed and stored at 10°C until the time for the analysis.

2.3. Analytical Procedure

The proximate, mineral, vitamin and phytochemical analysis were carried out in the Biochemistry Laboratory of National Root Crops Research Institute, Umudike, Abia State.

Accessions	Collection Sites	Latitude (N)	Longitude (E)	Altitude (m)
Aba North	Obikabia	5° 8' 12.962"	7° 24' 7.268"	155
Isialangwa	Ntigha	5° 24’ 11’	7° 25’ 11.5’’	127
Umunochi	Umua	5° 19’ 37 11’	7° 23’ 32.4’’	111
Aba South	Obohia	5º 04'12.94"	7º 20'27.07"	180
Umuahia North	Ehimiri	5° 33' 29"	7° 28' 7"	146
Ikwuano	Umudike	5° 28’ 45’’	7° 32’ 45’’	152
Umuahia South	Ossiah	5° 46' 23.4"	7° 43' 99"	152
Osisioma	Umugasi	5° 15' 45.5"	7° 32' 27"	206
Obingwa	Umuoha	5° 9' 0.212"	7° 19' 49.256"	190
Isiukwato	Ovim	5°45'42.66"	7°27'52.06"	151
Bende	Item	5° 33’ 31.4’’	7° 38’ 0.92’’	140
Ohafia	Ebem	5° 37’ 0’’	7° 49’ 60’’	153

Table 1: Accessions of Pumpkin Seeds and Their Collection Sites

2.4. Proximate Analysis

The moisture content, ash contents, crude fibre of the samples were determined using the recommended method described by the Association of Official Analytical Chemist (AOAC, 2000). Dry matter was determined by method described by James (1995). The crude protein content was determined using the macro-kjeldahi method described by Onwunka (2005). Nitrogen free extract (NFE) referred to as soluble carbohydrate was calculated by subtracting all the other components (except fat and dry matter) from 100%. NFE - 100 - (% ash + % crude fibre + % crude protein + % moisture). The solvent extraction gravimetric method was used to determine the fat content as described by Udo et al. (2009).

2.5. Mineral Analysis

Phosphorus content was determined by the Molybdo vanadate method, calcium and magnesium content was done using the versanate EDTA, potassium and sodium were determined by the flame photometry method, all described by the Association of Official Analytical Chemist (AOAC, 2000). Vitamin E content was estimated by the method described by Pearson (1976).

2.6. Vitamin Analysis

Vitamin A, thiamin content (B1), niacin content (B3), and riboflavin content (B2) were done using spectrophotometric method described by James (1995). Vitamin C was determined using the methods described by Kirk and Sawyer (1998).

2.7. Phytochemical Analysis

Alkaloid was determined using the alkaline precipitation gravimetric method as described by Harborne (1998). Tannin, saponin, and oxalate contents were obtained by the method described by the Association of Official Analytical Chemists (AOAC, 2000). Hydrogen Cyanide (HCN) was determined using the alkaline extraction method described by Onwunka (2005).

2.8. Experimental Design and Data Analysis

A single factor experiment laid out in Complete Randomization Design (CRD) replicated three times was used. Data collected from average of triplicate readings were subjected to analysis of variance using Genstat Discovery Edition 4 (Genstat, 2007) software. The least significant difference test was used to identify significant differences among treatments means ($p<0.05$).

3. Results and Discussion

3.1. Proximate Composition of Some Accessions of Pumpkin Seeds from Abia State

The proximate composition of accessions of pumpkin seeds from Abia State is shown in Table 2. Significant differences (p<0.05) were observed among the seeds for moisture content, ash, crude fibre, ether extract, and dry matter content while crude protein and carbohydrate were not. Moisture content was highest in seeds from Bende (9.18%), Isukwuato (8.67%) and Ohfia (8.41%) and lowest in seeds from Umuahia South (5.77%) and Umuahia North (5.79%). This indicates that seeds of Bende, followed by Isukwato and Ohafia may exhibit lower storage potential than other seeds due to the fact that moisture content is most important factor which influences the quality and shelf life of the seed. The result is comparable to the report of Raphael et al., 2014 (5.662±0.016%) and Elinge et al., 2012 (5.00%) on pumpkin seeds and seed extracts respectively; lower than those obtained by Etong et al., 2013 (12.50%) for mango seeds but higher than those reported by Habib et al., 2015 (4.06%) on pumpkin seed and Egbebi, 2014 (1.41-1.55%) on melon seeds

The observed ash content was highest in Ikwuano and lowest in Aba North seeds (4.26% and 3.47% respectively). Ash content obtained was slightly lower than those of Nwofia et al., 2012 (3.07-7.54%) and Elinge et al., 2012 (5.50%) on *Cucurbits* seeds and Jacob et al., 2015 (6.70) on melon but comparable to Ogunbanjo (2016) and Egbebi (2014). The ash content (3.47 - 4.26%) results were close to that reported by Karaye et al., 2013 (3.89 - 4.64%) and Habib et al, 2015 (3.08%) on *Cucurbitaceae* seeds. The percentage of ash in a sample determines the inorganic content in the samples from where the mineral content could be obtained. So, sample with high ash content is expected to have high concentration of various mineral elements, which are expected to speed up metabolic processes, improve growth and development (Elinge et al., 2012). The seeds had a crude fibre content ranging from 1.62% (Isiukwato) to 1.95% (Aba South) and close to those obtained by Elinge et al., 2012 (1.00%) and Nwofia et al., 2012 (1.01-1.09%) but lower than that obtained by Habib et al, 2015 (2.91%) on pumkin seeds. Fibre containing food help to expand the inside walls of the colon, easing the passage of waste, and making it an effective anti-constipation. It lowers cholesterol level in the blood and reduces the risk of various cancers (Elinge et al., 2012).

Accessions	Moisture Content	Ash	Carbo-hydrate	Crude Fibre (%)	Crude protein	Ether extract	Dry Matter Content
ABA NORTH	5.82	3.47	0.60	1.84	20.51	28.58	94.18
ABA SOUTH	6.34	4.17	0.9	1.95	32.07	25.62	93.61
BENDE	9.18	4.24	0.62	1.77	19.41	26.59	90.82
IKWUANO	6.19	4.26	0.60	1.72	20.97	27.73	93.81
ISIALANGWA	6.39	3.93	0.60	1.69	21.09	26.77	93.61
ISUKWUATO	8.67	3.61	0.59	1.62	21.72	23.23	91.34
OBINGWA	6.54	3.78	0.60	1.72	21.68	26.66	93.46
OHAFIA	8.41	3.67	0.59	1.75	17.19	24.71	91.59
OSISIOMA	7.67	3.82	0.60	1.64	20.85	24.78	92.34
UMUAHIA NORTH	5.79	3.50	0.57	1.80	20.95	24.18	94.21
UMUAHIS SOUTH	5.77	3.87	0.61	1.92	23.20	27.63	94.23
UMUNOCHI	6.32	3.87	0.58	1.66	21.52	26.53	93.68
Mean	6.92	3.85	0.62	1.76	21.76	26.08	93.07
LSD $_{(0.05)}$	0.38	0.10	NS	0.07	NS	0.34	0.39
C V (%)	2.50	1.20	20.00	1.90	21.20	0.60	0.20

Table 2: Proximate Composition of Seeds of Some Accessions of Cucurbita Accessions from Abia State
V - Coefficient of Variation, NS – Not Significant

Accessions	Calcium	Magnesium	Iron Mg/100g	Sodium	Potassium	Phosphorus
ABA NORTH	31.63	69.52	2.92	167.07	242.78	48.54
ABA SOUTH	31.72	63.64	2.87	160.49	238.67	51.44
BENDE	27.62	67.63	2.62	152.50	238.55	54.82
IKWUANO	30.64	65.77	2.79	170.66	236.67	52.45
ISIALANGWA	32.78	71.72	3.14	164.86	260.64	49.56
ISUKWUATO	31.72	65.78	3.23	166.77	245.78	46.06
OBINGWA	27.53	71.56	2.79	160.44	216.69	49.44
OHAFIA	29.47	75.87	3.34	155.25	260.32	58.64
OSISIOMA	29.55	69.37	3.41	158.84	263.66	52.63
UMUAHIA NORTH	28.63	68.62	3.17	158.55	262.76	48.75
UMUAHIS SOUTH	28.42	69.82	2.84	154.60	259.54	50.77
UMUNOCHI	25.82	73.51	3.61	149.58	258.50	50.72
MEAN	29.63	69.40	3.06	151.63	232.88	51.15
LSD $_{(0.05)}$	0.46	0.38	0.09	2.68	0.62	0.84
CV (%)	0.70	0.30	1.40	0.80	0.10	0.80

Table 3: Mineral Composition of Seeds of Some Accessions of Cucurbita Accessions from Abia State
CV - Coefficient of Variation

The value of fat (ether extract) in the seed determines it being referred to as oil seed or not. Fat is important because it provides the body with tremendous energy. Ether extract was highest in Aba North (28.58%) and lowest in Isiukwato (23.23%) seeds and an average of 26.08% for all the seeds studied. The result was found to be lower than the report of Habib et al, 2015 (36.70%)-, Raphael et al., 2014 (43%) and Elinge et. al., 2012 (38%) on *Cucurbita* spp seeds; Jacob et al., 2015 (49.05%); Egbebi, 2014 (44-55%) and Ogunbanjo et al., 2016 (41.8-48.75%) for melon seed but significantly higher than those reported by Gofur et al. 1993 (4.00%) for *Cassia fistula* seeds, Abulude, 2000 (5.92-13.50%) for different cultivars of mango kernels and (0.10-0.15%) for ripe and unripe *Carica papaya* seeds. This confirms the report of Zanish et al., 2013 that the nutritional value of the *Cucurbitaceae* seeds is dependent on the strain, species type as well as climatic conditions where it is grown.

The dry matter contents values obtained were greatest in seeds from Umuahia South (94.23%) and least in Bende seed (90.82%). Dry matter content was very high (90.82-94.23%) and in line with that obtained by Jacob et al. 2015 (92.90%) for melon seeds. Protein content is 17.19 - 32.01% which is comparable to those reported by Bankole et al., 2005 for *Colocynthis citrullus* seeds (28.63%); Jacob *et al.,* 2015 (30.63%) for *Citrullus lanatus, and* Elinge et al., 2012 (27.48%) for Cucurbita pepo L seeds. Diet is nutritionally satisfactory if it contains high caloric value and a sufficient amount of protein (Ene-Obong, 1992). According to Ali (2010) and Effiong et al. (2009), any plant foods that provide about 12% of their caloric value from protein are considered good source of protein and of which the seeds of these accessions were in line with this report. The carbohydrate content ranged from (0.57%) in Umuahia South to 0.90% in Aba South seeds. Carbohydrate is very low and the seeds of pumpkin cannot be considered as source of carbohydrate.

3.2. Mineral Composition of Accessions of Pumpkins Seeds from Abia State

The mineral composition of accessions of pumpkin seeds from Abia State is shown in Table 3. Significant differences (p<0.05) were observed among the seeds for minerals measured. Potassium is the most abundant element contained in the pumpkin seeds. According to Adeyeye, 2002, high amount of potassium in body increases iron utilization and beneficial to those talking diuretics to control hypertension. It ranged from 236.67- 263.66 mg/100g in Ikwuano and Osisioma seeds respectively. This is in line with the report (237 mg/100g) of Elinge et al., 2012 on pumpkin seeds and higher than Karanja et al., 2014 (166–191 mg/100g) on pumpkin fruit pulp. This is followed by sodium with values ranging from 149.58-170 mg/100g in Umunochi and Ikwuano seeds. Similar report was obtained by Raphael et al., 2014 (67mg/100g) on pumpkin gourd. Results for other minerals were: calcium (25.82 to 32.78 mg/100g) in Umunochi and Isialangwa seeds, iron (2.62 to 3.61 mg/100g) in Bende and Umunochi seeds, magnesium (63.64 to 75.87 mg/100g) in Aba South and Ohafia seeds. The observed mineral contents (calcium, magnesium, sodium, potassium and phosphorus) were high except in iron. Adeyeye (2002) reported that high amount of potassium in the body increases iron utilization. Sodium (66.77-170.66 mg/100 g) is required by the body to regulate blood pressure and blood volume and proper functioning of muscles and nerves (Payne 1990). The value of sodium, magnesium, iron and potassium values obtained were comparable to that reported by Elinge et al. (2012). The high values obtained for calcium (25.82-32.78 mg/100 g), magnesium (63.64-75.87 mg/100 g) and phosphorus (46.06-58.64 mg/100 g) shows that pumpkin seeds are good sources of minerals.

3.3. Vitamin Composition of Accessions of Pumpkin Seeds from Abia State

The Vitamin composition of some accessions of pumpkin seeds from Abia State is shown in Table 4. There were significant differences (P<0.05) observed among the seeds for Vitamin A, C, E, and Thiamin (B1) while Niacin (B3) and Riboflavin (B2) were not significantly different among the seeds. Vitamin A varied from 0.19 mg/100g in Aba South to 0.44 mg/100g in Isialangwa seeds. Vitamin C ranged from 0.31 mg/100g in Ikwuano to 0.77 mg/100g in Umunochi seeds. Thiamin varied from 0.04 mg/100g in Aba South to 0.08 mg/100g in Ikwuano seeds. The Niacin content ranged from 0.05 mg/100g in Isiukwato to 0.51 mg/100 g in Aba North seeds. The Riboflavin ranged from 0.02 mg/100g in Aba South to 0.04 mg/100g in Bende, Ikwuano, Isiukwato, Osisioma and Umunochi seeds respectively. Vitamin E has the highest vitamin content ranging from 1.19 mg/100g in Obingwa to 1.48 mg/100g in Umunochi seeds. The values obtained for thiamin is in line with the study carried out by Nwofia et al. (2012) (0.04-0.07 mg/100g). Vitamin E has potential in providing protection from free radicals and products of oxygenation. It works in conjunction with other antioxidants and nutrients to quench free radicals. It also inhibits lipoxygenation, an enzyme responsible for the formation of proinflammatory leukotrienes (Anon, 2002).

	Vitamins		**(mg/100g)**			
Accessions	**B1**	**B2**	**B3**	**E**	**C**	A
ABA NORTH	0.04	0.03	0.51	1.45	0.53	0.23
ABA SOUTH	0.06	0.02	0.08	1.43	0.50	0.19
BENDE	0.07	0.04	0.07	1.34	0.73	0.24
IKWUANO	0.08	0.04	0.07	1.36	0.31	0.20
ISIALANGWA	0.06	0.03	0.08	1.33	0.61	0.44
ISUKWUATO	0.05	0.04	0.05	1.41	0.74	0.19
OBINGWA	0.06	0.03	0.07	1.19	0.65	0.24
OHAFIA	0.06	0.03	0.07	1.23	0.63	0.27
OSISIOMA	0.07	0.04	0.08	1.26	0.68	0.34
UMUAHIA NORTH	0.07	0.03	0.06	1.28	0.74	0.30
UMUAHIS SOUTH	0.07	0.03	0.08	1.26	0.70	0.25

	Vitamins		(mg/100g)			
Accessions	**B1**	**B2**	**B3**	**E**	**C**	A
UMUNOCHI	0.06	0.04	0.07	1.48	0.77	0.30
MEAN	0.06	0.03	0.11	1.33	0.63	0.27
LSD $_{(0.05)}$	0.00	NS	NS	0.04	0.23	0.02
CV (%)	2.80	17.50	169.30	1.50	16.50	3.60

Table 4: Vitamins Composition of Seeds of Some Accessions of Cucurbita Accessions from Abia State
CV - Coefficient of Variation, NS – Not Significant
A, B, and C = Vitamins, Thiamin Content (B1), Niacin Content (B3), and Riboflavin Content (B2)

3.4. Phytochemical Composition of Accessions of Pumpkin Seeds from Abia State

The phytochemical composition of some accessions of pumpkin seeds from Abia State is shown in Table 5. There was significant variation among the seeds for alkaloids, oxalate, saponin, HCN and phytate but tannin did not significantly differ among the seeds. The Alkaloid contents of the seed ranged from 0.04% (Ikwuano and Umuahia South) to 0.67% (Umunochi seeds). The HCN content of the seed varied from 0.30% in Obingwa to 0.73% in Osisioma seeds. The Tannin content of the seed ranged from 0.04% in Bende and Obingwa to 0.34% in Osisioma seeds. The oxalate content ranged from 0.04% in Ikwuano and Obingwa to 0.06% in Isialangwa, Aba South, Isiukwato and Ohafia seeds. The Phytate content of the seeds ranged from 0.20% in Bende to 0.44% in Isiukwato seeds while saponin content ranged from 0.05% in Bende to 0.09% in Isialangwa, Umunochi, Umuahia North and South seeds. The pumpkin seeds exhibited very low values on antinutrients evaluated. The values obtained will make the detected nutrient in the sample available for utilization by the body for both its metabolic and physiological activities. The level of tannin contain in these accessions is very low and according to Lewis (1996) it could limit the absorption of the vital nutrients i.e., iron and protein. The amount of phytate obtained (0.20-0.44%) was in line with that identified by Karaye et al., (2013) on *Cucurbita* seeds (0.20-0.40%) while HCN is slightly higher than Karaye et al. (2013).

Accessions	**Alkaloids**	**Tannin**	**Oxalate**	**Saponin** (%)	**HCN**	**Phytate**
ABA NORTH	0.37	0.07	0.05	0.08	0.34	0.28
ABA SOUTH	0.42	0.05	0.06	0.07	0.45	0.24
BENDE	0.46	0.04	0.05	0.05	0.39	0.20
IKWUANO	0.04	0.05	0.04	0.06	0.51	0.25
ISIALANGWA	0.39	0.05	0.06	0.09	0.38	0.41
ISUKWUATO	0.59	0.07	0.06	0.08	0.54	0.44
OBINGWA	0.42	0.04	0.05	0.06	0.30	0.28
OHAFIA	0.60	0.07	0.06	0.08	0.61	0.37
OSISIOMA	0.45	0.34	0.04	0.07	0.73	0.43
UMUAHIA NORTH	0.64	0.07	0.05	0.09	0.52	0.32
UMUAHIS SOUTH	0.04	0.06	0.05	0.09	0.63	0.33
UMUNOCHI	0.67	0.08	0.06	0.09	0.63	0.36
MEAN	0.42	0.08	0.05	0.08	0.50	0.34
LSD $_{(0.05)}$	0.02	NS	0.00	0.00	0.02	0.03
CV (%)	2.10	137.30	2.10	2.40	2.00	3.60

Table 5: Phytochemical Composition of Seeds of Some Accessions of Cucurbita Accessions from Abia State
CV - Coefficient of Variation, NS – Not Significant

4. Conclusion

All the accessions of pumpkin seeds studied exhibited high content of crude protein, Ether extract and very high dry matter content. Pumpkin seeds of Umuahia South, Umuahia North and Aba North had the lowest moisture content and highest dry matter content. Their seeds would have highest storability potential and also have the highest amount of nutrients that are available for consumption than others. Umuahia South and Aba North seeds had highest crude fat which means that these are good source of oil.

Bende, Isiukwato, and Ohafia seeds that had the highest moisture content also had the lowest dry matter content. These three pumpkin seeds were from Abia North and had warty pods.

Pumpkin seeds evaluated showed that they are rich in potassium, sodium, phosphorus, magnesium, and calcium, which makes it a good source of minerals. The low concentration of phytochemicals indicates that pumpkin seed is a good source of food for human and animals.

5. References

i. Abulude, F. O. (2000). Chemical composition and Nutritive values of *Carica papaya* and *Citrus sinensis* seeds. *The Journal of Techno Science, 4*, 24-27.

ii. Adeyeye, E. I. (2002). Determination of the Chemical Composition of the Nutritionally Valuable Parts of Male and Female Common West African Fresh Water Crab (Sudananoutesafricanus). *International Journal of Food Sciences and Nutrition, 53*, 189-196.

iii. Ali, A. (2010). A Comparative Study of Nutrients and Mineral Molar Ratios of Some Plant Foods with Recommended Dietary Allowances. *Advance Journal of Food Science and Technology, 2*(2), 104-108.

iv. Anon. (2002). *Mixed Tocophenols*. Alternative Medicine Review, 7,421-427.

v. AOAC (2000). *Official Methods of Analysis of the Association of the Analytical Chemists.* 17th ed. Inc. Virginia, Washington DC, USA.

vi. Aruah, C. B., Uguru, M. I. & Oyiga, B. C. (2011). Nutritional evaluation of some Nigerian pumpkins (*Cucurbita spp*). *Fruit, Vegetable and cereal Science and Biotechnology, 5,* (2), 64-71.

vii. Bankole, S. A., Osio, A., Joda, A. O. & Kuomehin, O. A. En. (2005). Effect of drying method on the quality and storability of *Colocynthsis citrullus. African Journal of Biotechnology, 4*(8), 799-803.

viii. Delahaut, K. A. & Newenhouse, A. C. (2006). *Growing pumpkin and other vine crops in Wisconsin: A guide for fresh market growers (A3688).* University of Wisconsin. Extension Publication, p. 2.

ix. Effiong, G. S., Ibia, T. O & Udofia, U. S. (2009). Nutritive and Energy Values of Some Wild Fruit Spices in Southeastern Nigerian. *Electronic Journal of Environmental, Agricultural and Food Chemistry, 8* (10), 917-923.

x. Egbebi, A. O. (2014). Comparative studies on the three different species melon seed; (*Citrulus vulgaries, Cucumeropsis manni* and *Leganaria siceraria*). *Sky Journal of Food Science, 3*(1), 001 – 004.

xi. Elinge, C. M., Muhammad, A., Atiku, F. A., Itodo A. U., Peni, I. J., Sanni, O. M., et al. (2012). Proximate, Mineral and Anti-nutritional Composition of Pumpkin (*Cucurbita pepo* Mbongo *L.*) Seeds Extracts. *International Journal of Plant Research, 2*(5), 146-150.

xii. Etong, D. I., Ayeni, K. E., Ajayi, O. O. and Oladimeji, M. O. (2013). Physicochemical properties and Nutritional values of Melina fruit (*Gmelina arboreal*) and mango (*Mangifera indica*) seed. *International Journal of Conservation Science, 6*(1), 56-62.

xiii. Genstat, (2007). *Genstat for windows, Discovery (3rd Edn.)*. Lawes Agricultural trust, Rothamsted Experimantal station, UK.

xiv. Gofur, M. A., Rahman, M. S., Ahmed Hossian, M. G. & Haque, M. E. A. (1993). Studies on the characterization and glyceride composition of Tobacco (*Nicotiana tabacum* L.) seed oil, *B. J. Sci Ind Res, 28*, 25-31.

xv. Habib, A., Biswas, S., Siddique, A. H., Manirujjaman, M., Uddin, B., *et al*. (2015). Nutritional and Lipid Composition Analysis of Pumpkin Seed (*Cucurbita maxima Linn*.). *Journal of Nutrition and Food Sciences 5*, 374.

xvi. Harborne, J. B. (1998). *Phytochemicals Methods. 3rd Edition.* Chapman and Hall Limited, Londres.

xvii. Jacob, A. G., Etong, D. I. & Tijjani, A.1. (2015). Proximate, Mineral and Anti-nutritional Compositions of Melon (*Citrullus lanatus*) Seeds. *British Journal of Research 2*(5), 142-151.

xviii. James, C. S. (1995). *Analytical Chemistry of Foods*. Chapman and Hall, New York, pp:18.

xix. Karanja, J. K., Mugendi, B. J., Khamis, F. M. & Muchugi, A. N. (2013). Nutritional Composition of the Pumpkin (*Cucurbita* spp.) Seed Cultivated from Selected Regions in Kenya. *Journal of Hort Letters, 3*. p. 17-22.

xx. Karanja, J. K., Mugendi, B. J., Khamis1, F. M. & Muchugi, A. N. (2014). Nutritional Evaluation of Some Kenyan Pumpkins (*Cucurbita* spp.). *International Journal of Agriculture and Forestry 4*(3), 195-200.

xxi. Karaye, I. U., Aliero, A. A., Muhammad, S. & Bilbis, L. S. (2013). Evaluation of Nutrient and Anti-nutrient Contents of Selected Nigerian Cucurbits Seeds. *Research Journal of Pharmaceutical, Biological and Chemical Sciences; 4*, 137.

xxii. Kirk, R. S & Sawyer, R. (1998). *Pearson's Composition and Composition Analysis of Foods*. 9th ed. Churchill Livingstone, Edinburgh.

xxiii. Lewis, T. J. (1996). Tannin. *Journal of Amer Oriental Soc. Ct 13*, 33-34.

xxiv. Nwofia, G.E., Nwogu, V. & Nwofia, B. K. (2012). Nutritional variation in fruits and seeds of pumpkins (*Cucurbita* spp) accessions from Nigeria. *Pakistan Journal of Nutrition 11* (10), 848-858, ISSN 1680-5194.

xxv. Ogunbanjo, O. R., Awotoye, O. O., Jayeoba, F. M., & Jeminiwa, S. M. (2016). Nutritional Analysis of Selected *Cucurbitaceae* Species. *Universal Journal of Plant Science 4*(1), 1-3.

xxvi. Okoli, E. E. and Okoronkwo, C. M. (2020). Heritability and combining ability estimate among seven varieties of maize in Southeastern Nigeria. *International Journal of Science, Environment and Technology, 9*(2), 98– 107.

xxvii. Onwuka, G. I. (2005). *Food Analysis and Instrumentation (Theory and Practice).* Naphthali prints, Lagos.

xxviii. Payne, W. J. A. (1990). *An Introduction to Animal Husbandry in the Trophics*. Longman Publishers Singapore, p. 92-110.

xxix. Pearson, D. (1976). *Chemical Analysis of Foods.* Churchill Livingstone, Edinburgh.

xxx. Raphael, K., Clive, W., Amos, M., Misheck, M., Clarice, N., Perkins, M., et al. (2014). Proximate Composition of Pumpkin Gourd (*Cucurbita Pepo*) Seeds from Zimbabwe. *International Journal of Nutrition and Food Sciences 3*(4), 279-283.

xxxi. Tadmor, Y., Paris, H. S., Meir, A., Schaffer, A. A. & Lewinsohn, E. (2005). Dual role of the pigmentation gene B in affecting carotenoid and vitamin E content in squash (*Cucurbita pepo*) mesocarp. *Journal of Agric. Food Chem. 53*, 9759–9763.

xxxii. Udo, E. J., Ibia, T. O., Ogunwale, J. A., Ano, A. O. & Esu, I. E. (2009). *Manual of Soil, Plant and Water Analysis.* Sibon books Limited, Lagos.

xxxiii. Zanish, A., Workneth, T.S & Woldetsadk, K. (2013). Effects of accessions on the Chemical quality of fresh pumpkin. *African Journal of Biotechnology, 12* (51), 7092-7098.