



NUTRITIONAL STUDY ON THE SEEDS AND FRUITS OF THREE CUCURBITS IN SOUTH WESTERN NIGERIA.

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ABSTRACT

A comparative study was carried out on the nutritional contents of the seeds and fruits of *Cucumis melo* (L.), *Lagenaria breviflora* (Benth) and *Citrullus lanatus* (Thunb). Proximate composition, Vitamin C content and phytochemical analysis of air-dried, powdered epicarp, mesocarp and seeds of the mature fruits were also carried out using standard procedures. Data on nutritional and phytochemical characteristics were collected and subjected to two-way analysis of variance (ANOVA) at $p < 0.05$. Means were compared using LSD. Total sugar and vitamins C were detected in the other parts of the fruits except the seeds in the three Cucurbits. Percentage dry matter, fat, ash and crude protein were significantly ($p < 0.05$) higher in the seeds than in the epicarp and mesocarp. Crude fibre was highest in the epicarp for *C. melo* (1.75 ± 0.13), *L. breviflora* (1.85 ± 0.07) and *C. lanatus* (2.18 ± 0.07).

INTRODUCTION

Cucurbitaceae comprises both cultivated and wild species. Many of these have been domesticated and grown as vegetables forming basic ingredients for human diet (Thoenissen *et al.*, 2009). They are herbaceous vines (Khan *et al.*, 2013), commonly called the “gourd family” of flowering plants and collectively known as cucurbits (Kocyan *et al.*, 2007). They contain about 125 genera and 980 species (Deyo and O’Malley, 2008) and are well represented in Nigeria by 21 genera, many of which are considered economically important (Ogbonna *et al.*, 2007). They are cultivated in different parts of the world for their nutritional value as food, plant rich in vitamins, phosphorus, calcium, protein, carbohydrates etc

MATERIALS AND METHODS

Fruit and seed collection

Mature fruits of the three members of the *Cucurbitaceae* family (*Lagenaria breviflora*, *Cucumis melo*, *Citrullus lanatus*) were randomly selected and bought from local farmers at Osiele market in Abeokuta, Ogun State. The seeds were extracted manually from their mature fruits which were left for 10 days to rot in the case of *Lagenaria breviflora* and *Cucumis melo*. The seeds of *Citrullus lanatus* were also extracted manually after the mature fruit have been cut longitudinally with a knife. Ten grammes (10g) of the seeds was grounded using a sony electric blender into powdery form which was used for proximate analysis. Each longitudinally dissected mature fresh fruit was peeled to collect their epicarp and mesocarp which were oven dried and ground separately to powdery form for proximate analysis.

Nutritional composition

Proximate Analysis Test was carried out using the spectrophotometer according to the method described by A O A C (2000). The component of the analysis made include; moisture content, fat content, ash content, crude fibre content, crude protein, carbohydrate and soluble sugar content.

Soluble sugar content

Dry samples (epicarp, mesocarp and seeds) of 0.020 – 0.025 g each were weighed into separate centrifuge tubes and moistened with 1.0 ml ethanol. 2.0 ml distilled water and 10 ml hot ethanol was then added and vortex. The mixture was centrifuged for 10 minutes at 2000 rpm, after which the supernatant was decanted into a test tube and made up to 20 ml extract. 0.8 ml of distilled water, 0.5 ml of 5 % phenol respectively was added to 0.01 – 1 ml of extract and

vortexed. 2.50 ml of conc sulphuric acid was added and vortexed, mixture was allowed to cool for the absorbance to be read at 490nm.

Calculation was carried out thus;

$$\% \text{ Sugar} = \frac{(A-I) \times D.F \times V \times 100}{B \times W \times 1000000}$$

Where; A = Absorbance of sample,

I = Intercept of sample,

D.F = Dilution Factor,

V = Volume,

B = Slope of the standard curve and

W = Weight of the sample

Crude protein

The principle behind this method is the conversion of the nitrogen of the nitrogenous substance into ammonia by boiling with conc sulphuric acid fixed by excess of acid as ammonium sulphate.

Dried samples of (epicarp, mesocarp and seed) 0.2 g of each were weighed separately into three Kjeldahl flask. 1g of CuSO_4 added to each flask followed by 1 tablet of kjeldahl catalyst selenium (each tablet contains 1g Na_2SO_4 – 0.05 g selenium). To the mixture 25 ml concentrated sulphuric acid and 5 glass beads was introduced (glass beads helped prevent bumping during heating)

The mixture was heated in a fume cupboard very gently at first and then increased with occasional shaking till the solution assumed green colour, the solution was then cooled. The black particle accumulated at the mouth and neck of the flask was washed down with distilled water.

Heating was repeated first gently and then increased again until the green colouration disappeared. This was then allowed to cool, after which the digest was transferred with several washings into a 100ml volumetric flask and made up to mark by adding distilled water. Distillation was then carried out using Markham distillation apparatus.

Distillation

The Markham distillation apparatus was steamed for 15 minutes before use. A 100 ml conical flask containing 20 ml boric acid indicator was placed under the condenser such that the condenser tip was under the liquid.

The digest (10 ml) was pipetted into the body of the apparatus via the small funnel aperture and then washed down with distilled water, followed by 20 ml of 40 % NaOH. This was steamed through for

5 – 7 minutes in order to collect enough ammonium sulphate. The receiving flask was removed afterwards and the condenser tip washed down into the flask. The flame was removed so as to bring about development of a vacuum for the removal of the condensed water. Solution in the receiving flask was titrated using N/100 (0.01 N) hydrochloric acid
Crude protein was calculated thus;

$$\%N = \frac{T.V \times (N \text{ acid}) \times 0.01401 \times DM \times \text{Volume of digest}}{W (\text{Sample weight}) \times \text{Volume of digest used}}$$

Where; N acid = 0.01N, DM = Dry matter content, Volume of digest = 100ml Volume of digest used = 20ml, Sample weight (W) = 0.2g

Therefore; Crude protein (Cp) = % N x 6.25

Moisture content

Each sample (epicarp, mesocarp and seeds) were thoroughly mixed and ground separately using laboratory mortar and pestle. 5 g of each sample were then rapidly transferred into three pre- weighed drying dish, after which each was dried to a constant weight at (95 – 100)^oC under pressure (100 mmHg) for about 5 hours.

At the end of drying, each dish was placed in a desiccator to cool. Each samples were reweighed and loss in weight was reported as moisture.

$$\% \text{ Moisture content} = \frac{W2 - W3}{W1} \times 100$$

Where; W1 = Initial weight of empty crucible, W2 = Weight of crucible + food before drying, W3 = Final weight of crucible + food after drying.

% Total dry matter = 100 - % moisture content.

Ash content

Finely dry ground samples of 2.5 g of the epicarp, mesocarp and seeds were weighed separately into three porcelain crucibles. Each sample was charred on a Bunsen flame inside a fume cupboard to drive off smoke. Each sample was then transferred into a pre-heated muffle furnace at 550^oC and left for two hours until white or light grey ash was observed.

$$\% \text{Ash(dry basis)} = \frac{\text{Weight of ash (W3 - W1)}}{\text{Weight of original food(W2 - W1)}} \times 100$$

Where; W1 = weight of empty crucible,
W2 = weight of crucible + food before drying,
W3 = weight of crucible + ash

Fat content,

A clean 250 cm³ boiling flasks was dried in the oven at 105 – 110^oC for 30 minutes. It was then cooled in a desiccator. 2 g of each sample (epicarp, mesocarp and seeds) were weighed into separate labeled thimbles correspondingly, cooled boiling flasks were weighed and filled with 300 cm³petroleum ether boiling at 40 – 60^oC. The extraction thimbles were plugged lightly with cotton wool, the soxhlet apparatus was assembled and allowed to reflux for 6 hours. Each thimble was removed with care and the petroleum etheron top was collected for re-use.

After each flask was almost free of petroleum ether, they were removed and dried at 105 – 110 ^oC for one hour, after which each was transferred from the oven to the desiccators and were allowed to cool.

% Fat content was calculated thus;

$$= \frac{\text{Weight of fat}}{\text{Weight of sample}} \times 100$$

Crude fibre content

Well ground sample (epicarp, mesocarp and seeds) each of 1 g were weighed into a 500 ml Conical flask and 1 ml digestion reagent was added washing down the sides of the flask. It was then boiled and refluxed for 40 minutes, a water jacketed condenser was used to prevent loss of liquid, the flask was then removed from the heater and was cooled under cold tap, filtered and washed six times with hot water and once with methylated spirit.

The residue was taken out with a spatula and transferred to a silica dish and dried overnight at 105^oC. It was then transferred to a desiccators where it was cooled and weighed.

$$\% \text{ Fibre} = \frac{\text{Difference in weighing}}{\text{Weight of Sample}} \times 100$$

Carbohydrate content was calculated by difference that is;

$$\text{Carbohydrate} = 100 - (\text{MC} + \text{FC} + \text{AC} + \text{CF} + \text{CP})$$

Where; MC =Moisture content,
FC = Fat content,
AC = Ash content
CF = Crude fibre content,
CP = Crude protein content

Statistical Analysis

All data collected from the above experiments were analyzed using two way analysis of variance (ANOVA) and means were compared using LSD. P value was set at ≤ 0.05 .

RESULTS

Nutritional composition of the epicarp, mesocarp and seeds of *C. melo*, *L. breviflora* and *C. lanatus*

Nutritional composition of the epicarp, mesocarp and seeds of *C. melo*, *L. breviflora* and *C. lanatus* is shown in Table 1.

Seeds of *C. lanatus* had significantly highest dry matter (95.79 g) and carbohydrate (25.52 g) while seeds of

L. breviflora had the highest fat (3.72 g) content. On the other hand, seeds of *C. melo* had significantly the highest ash (3.72 g) and crude protein (28.10 g).

Moisture content was highest (91.02) in the mesocarp of *C. melo* while crude fibre content was highest (2.18) in the epicarp *C. lanatus*.

Sugar and Vitamin C were not detected in the seeds of *C. melo*, *L. breviflora* and *C. lanatus*. High sugar content was recorded in the mesocarp of *C. melo* and *L. breviflora* than in their epicarps. Sugar was only detected in the epicarp of *C. lanatus*. However, vitamin C content were highest (38.82 g) in the epicarp of *L. breviflora*.

Table 1: Nutritional composition of the epicarp, mesocarp and seeds of *C. melo*, *L. breviflora* and *C. lanatus*

Nutritional content	Epicarp			Mesocarp			Seed		
	<i>Cucumis melo</i>	<i>Lagenaria breviflora</i>	<i>Citrullus lanatus</i>	<i>Cucumis melo</i>	<i>Lagenaria breviflora</i>	<i>Citrullus lanatus</i>	<i>Cucumis melo</i>	<i>Lagenaria breviflora</i>	<i>Citrullus lanatus</i>
Moisture	76.96±1.27 ^b	73.17±0.28 ^b	71.70±0.22 ^b	91.02±0.16 ^c	90.05±0.14 ^c	90.45±0.21 ^c	5.48±0.36 ^a	4.90±0.02 ^a	4.22±0.11 ^a
Drymatter	23.05±1.27 ^b	26.83±0.28 ^b	28.30±0.22 ^b	8.98±0.16 ^a	9.95±0.14 ^a	9.56±0.21 ^a	94.52±0.36 ^c	95.10±0.02 ^c	95.79±0.11 ^c
Fat	0.40±0.02 ^a	0.59±0.03 ^a	0.53±0.06 ^a	0.20±0.02 ^a	0.21±0.03 ^a	0.22±0.02 ^a	46.58±0.32 ^c	59.02±0.41 ^b	42.04±0.13 ^c
Ash	1.19±0.06 ^b	1.19±0.05 ^b	1.55±0.04 ^b	0.32±0.02 ^a	0.76±0.02 ^a	0.65±0.03 ^a	3.72±0.06 ^c	3.19±0.07 ^c	2.72±0.14 ^c
Crude fibre	1.75±0.13 ^c	1.85±0.07 ^c	2.18±0.07 ^c	0.43±0.02 ^a	0.91±0.02 ^a	0.83±0.02 ^b	0.79±0.04 ^b	1.20±0.07 ^b	0.64±0.03 ^a
Crude protein	1.97±0.05 ^b	1.81±0.09 ^b	1.30±0.07 ^a	0.61±0.07 ^a	0.84±0.03 ^a	0.52±0.04 ^a	28.10±0.18 ^c	26.32±0.20 ^c	12.06±9.73 ^a
Carbohydrate	17.74±1.52 ^b	21.40±0.51 ^b	22.76±0.45 ^c	7.42±0.06 ^a	7.25±0.23 ^a	7.62±0.44 ^a	7.56±7.56 ^a	5.34±0.68 ^a	25.52±3.74 ^b
% Sugar	1.40±0.10 ^b	2.00±0.10 ^b	1.50±0.10 ^b	6.35±0.15 ^c	7.70±0.10 ^c	ND	ND	ND	ND
	8.22±0.04 ^c	38.82±0.11 ^c	8.39±0.06 ^c	8.00±0.02 ^b	36.64±0.19 ^b	8.14±0.03 ^b	ND	ND	ND

^{abc}Mean values (± Standard Error) with the same superscript in the same row for each species are not significantly different (p>0.05) (ND = Not Detected)

DISCUSSION

Crude protein were found to be significantly high in the seeds of *C. melo*, *L. breviflora* and *C. lanatus* than in their epicarp and mesocarp. This could be attributed to the fact that they are the food reserve center that is where food is stored for the later growth of the embryo (Kaur *et al.*, 1988). The seed being a major sink and must possess the highest store of the yield components. Badifu (1993) reported that Cucurbits were rich in nutrients such as protein. This result conforms with the reports of Oyeleke *et al.*, (2012), Ojokoh and Lawal (2010) and Nzikou *et al.*, (2009).

The fat content of the seeds of *L. breviflora* was highest. These seeds have been reported to contain high fat deposits and hence valued as oil seeds (De Mello *et al.*, 2001). This is also similar to the report on the fat content of some varieties of *C. pepo* by Murkovic *et al.*, (1996).

Crude fibre was found to be higher in the epicarp of *C. lanatus* compared to that recorded for *Jatropha cathartica* (Oladele and Oshodi, 2007). Fibre is an important part of food even though it cannot be digested, it reduces cholesterol levels and

aids the normal functioning of the intestinal tract by increasing stool bulk and decreasing the duration for which the waste can stay in the gastrointestinal tract (Bello *et al.*, 2008). It may have helped to boost the protective role of the epicarp, giving it rigidity which helps give the fruit its shape.

C. lanatus also recorded highest carbohydrate content in the seed compared to the other parts. Carbohydrates are energy renewers, a very good source of human nutrition. This was almost the same as the 26% content reported for sunflower (FAO, 1982) but varied with the report of Okoye (2013) where the carbohydrate content of *Cucumis sativus*, *Cucurbita pepo*, *Cucurbita moschata* and *Trichosanthes cucumerina* were very high.

Sugar and vitamin C were not detected in the seeds of *C. melo*, *L. breviflora* and *C. lanatus* analysed in this study. However, the Vitamin C content of epicarp of *L. breviflora* was significantly higher. Vitamin C is an antioxidant with therapeutic properties which aids the formation of connective tissues, bones and blood vessels (Fadimu *et al.*, 2012). Its high content in the epicarp may further aid the protective functioning of the epicarp.

REFERENCES

- A.O.A.C. (2000). Association of Official Analytical Chemist, Official Methods of Analysis, Washington DC.
- Badifu G.I.O. (1993). Food potentials of some unconventional oilseed grown in Nigeria, a brief review. *Plant Food Human Nutrition*. 43:211-224
- Bello, M.O., Falade, O.S., Adewusi, S.R.A. and Olawore, N.O. (2008). Studies on the chemical compositions and anti-nutrients of some lesser known Nigerian fruits. *African Journal of Biotechnology*, 7(21): 3972 –3979.
- De-Mello, M.L.S., Bora, P.S., Narain, N. (2001). Fatty and amino acids composition of melon (*Cucumis melo* var. *saccharinus*) seeds. *Journal of Food consumption and analysis*, 14: 69-74
- Deyo, A. and O'malley, B. (2008). *Cucurbitaceae* in college seminar 235 food for thoughts: the science, culture & politics of food Pp 1 – 15
- Fadimu, O.Y., Ajiboye, A.A., Abgoola, D.A., Kadiri, M. and Adedire, M.O. (2012). Effect of some combination of phytohormone on some growth parameters and vitamin C, carbohydrate, protein, and chlorophyll contents of *Spondias mombin* (Linn.) seedling. *Ife Journal of Science*, 14(2): 397-403.
- FAO (1982). Food Composition Table for the near East. Nuts and Seeds. FAO Food and Nutri. Paper, 26. ISBN92-5-101277-6 p. 85.
- Kaur, M., Mann, S.K., Hira, C.K. and Bajaj, S. (1988). Effect of muskmelon (*Cucumis melo*) seed supplementation in the nutritive value of wheat chapatti. *Journal of Food Science and Technology*, 25: 263 – 266.
- Khan, A. R., Anwar, M. and Khan, M. J. (2013). Study of phytochrome mediated seed germination of *cucurbitaceaepepo* L. and *citrullus vulgaris* thumb. *Found in balochistan International Journal of Basic and Applied Sciences*, 13(2): 28-35.
- Kocyan, A., Zhang, L., Schaefer, H. and Renner S. (2007). A multi locus chloroplast phylogeny for the *Cucurbitaceae* and its implication for character evolution and classification. *Molecular Phylogenetics and Evolution*. 44:553-557.
- Murkovic, M., Hillebrand, A., Leither, J. and Pfannhanster, W. (1996). Variability of fatty acid content in Pumpkin seeds (*Cucurbita pepo* L.). *Zeitschrift- fuer – lebensmittel – untersuchung – und – forschung*, 203(3): 216 – 219.
- Nzikou, J. M., Mate, L., Bouanga-kalou, G., Ndangui, C. B., Pambou-tobi, N. P. G., Kimbonguila, A., Silo, T., Linder, M. and Desobry, S. (2009). Chemical composition of the seeds and oil of Sesame (*Sesamun indicum* L.) grown in Congo-Brazzaville. *Advanced Journal of Food Science and Technology*, 1(1): 6 – 11.
- Ogbonna, P.E. and Obi, I.Ojokoh, A. O. and Lawal, R. T. (2010). Changes in nutrient content of popcorn and groundnut composite flours subjected to solid substrate fermentation. *Inter. J. Tropical Med. and Pub. Health*, 1(1): 50 – 53.
- Ojokoh, A.O. and Lawal, R.T. (2010). Changes in nutrient content of popcorn and groundnut composite flours subjected to solid substrate fermentation. *Inter. J. Tropical Med. and Pub. Health*, 1(1): 50 – 53.
- Okoye, N.F. (2013). Proximate analysis and protein solubility of four Cucurbits found in Nigeria. *Pakistan Journal of Nutrition*, 12(1): 20 – 22.
- Oladele, P.E and Oshodi, A.A. (2007). Nutritional potential of *Jatropha cathartica*. *Pakistan Journal of Nutrition*, 6(4) : 345 – 348.
- Oyeleke, G.O., Olagunju, E.O., Ojo, A. (2012). Functional and physiocochemical properties of watermelon (*Citrulluslanatus*) seed and seed oil. *Journal of Applied Chemistry*, 2(2): 29-31.
- Thoennissen, N.H., Iwanska, G.B., Doan, N.B., Okamoto, R.Lin, P., Abbassi, S., Song, J. H., Yin, D., Toh, M., Xie, W. D., Said, J. W. and Koeffler, H. P. (2009). *Cucurbitacin* B induces apoptosis by inhibition of the JAS/STAT pathway and potentials antiproliferative effects of gemcitabime on pancreatic cancer cells. *Cancer Research*, 69: 5876.