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

Ojo, E.S., Ajiboye, A.A., Fawibe, O.O., Adetutu Bello and Agboola, D.A

1Department of Pure and Applied Botany, Federal University of Agriculture, Abeokuta, Nigeria.
2Department of Plant Sciences and Biotechnology, Federal University, Oye Ekiti
3Department of Biological Sciences, Covenant University Otta, Nigeria.

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, plantrich 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 rotten 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.

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 vortexed. 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

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 was weighed seperately into three Kjeldahl flask. 1g of CuSO\(_4\) added to each flask followed by 1tablet of kjeldahl catalyst selenium (each tablet contains 1g Na\(_2\)SO\(_4\) – 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 15minutes 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 other 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;

\[ %N = \frac{TV \times (N\ acid) \times 0.01401 \times DM \times Volume\ of\ digest}{Volume\ of\ digest\ used \times W\ (Sample\ weight)} \]

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 °C 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.

\[ %\ Moisture\ content = \frac{W2 - W3}{W1} \times 100 \]

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

**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°C and left for two hours until white or light grey ash was observed.

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

**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°C. It was then transferred to a desiccators where it was cooled and weighed.

\[ % Fibre = \frac{Difference\ in\ weighing}{Weight\ of\ Sample} \times 100 \]

Carbohydrate content was calculated by difference that is;

\[ Carbohydrate = 100 - (MC + FC + AC + CF + CP) \]

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

Fat content

A clean 250 cm³ boiling flasks was dried in the oven at 105 – 110°C 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. The boiling flasks were weighed and filled with 300 cm³ petroleum ether boiling at 40 – 60°C. 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 ether top was collected for re-use.

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

% Fat content was calculated thus;

\[ = \frac{Weight\ of\ fat}{Weight\ of\ sample} \times 100 \]

**Carbohydrate content**

\[ Carbohydrate = 100 - (MC + FC + AC + CF + CP) \]

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

**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°C. It was then transferred to a desiccators where it was cooled and weighed.

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

Carbohydrate content was calculated by difference that is;

\[ Carbohydrate = 100 - (MC + FC + AC + CF + CP) \]

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

Fat content

A clean 250 cm³ boiling flasks was dried in the oven at 105 – 110°C 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. The boiling flasks were weighed and filled with 300 cm³ petroleum ether boiling at 40 – 60°C. 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 ether top was collected for re-use.

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

% Fat content was calculated thus;

\[ = \frac{Weight\ of\ fat}{Weight\ of\ sample} \times 100 \]
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.

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 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 possesses 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. pepoby 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.

<table>
<thead>
<tr>
<th>Nutritional content</th>
<th>Epicarp</th>
<th>Mesocarp</th>
<th>Seed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cucumis melo</td>
<td>Lagenaria breviflora</td>
<td>Cucumis melo</td>
<td>Lagenaria breviflora</td>
</tr>
<tr>
<td>Moisture</td>
<td>76.95±1.27ᵇ</td>
<td>73.17±0.28ᵇ</td>
<td>71.70±0.22ᵇ</td>
</tr>
<tr>
<td>Drymatter</td>
<td>23.05±1.27ᵇ</td>
<td>26.83±0.28ᵇ</td>
<td>28.30±0.22ᵇ</td>
</tr>
<tr>
<td>Fat</td>
<td>0.40±0.02ᵃ</td>
<td>0.59±0.03ᵇ</td>
<td>0.53±0.06ᵇ</td>
</tr>
<tr>
<td>Ash</td>
<td>1.19±0.06ᶜ</td>
<td>1.19±0.08ᶜ</td>
<td>1.55±0.04ᵇ</td>
</tr>
<tr>
<td>Crude fibre</td>
<td>1.75±0.13ᶜ</td>
<td>1.85±0.07ᶜ</td>
<td>2.18±0.07ᶜ</td>
</tr>
<tr>
<td>Crude protein</td>
<td>1.97±0.05ᶜ</td>
<td>1.81±0.09ᶜ</td>
<td>1.30±0.07ᶜ</td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>17.74±1.52ᵇ</td>
<td>23.05±1.27ᵇ</td>
<td>26.83±0.28ᵇ</td>
</tr>
<tr>
<td>% Sugar</td>
<td>1.40±0.10ᵇ</td>
<td>2.00±0.10ᵇ</td>
<td>1.50±0.10ᵇ</td>
</tr>
<tr>
<td>Ash</td>
<td>8.22±0.04ᵇ</td>
<td>38.82±0.11ᵃ</td>
<td>8.39±0.06ᵇ</td>
</tr>
</tbody>
</table>

abcMean values (± Standard Error) with the same superscript in the same row for each species are not significantly different (p>0.05) (ND = Not Detected)
REFERENCES


