

Nutritional, Minerals and Phytochemicals composition of *Garcinia cola* [Bitter cola] and *Aframomum melegueta* [Alligator pepper]

¹Alaje D.O., ²Owolabi K.T., ¹Olakunle T.P., ³Oluoti O.J., ¹Adetuberu I.A.

¹Applied Sciences Department, Osun State Polytechnic, Iree

²Science Laboratory Technology Department, Osun State Polytechnic, Iree

³Food Science Technology Department, Osun state Polytechnic, Iree

Abstract: Samples of *Garcinia cola* and *Aframomum melegueta* were analyzed for their nutritional composition, minerals constituents and phytochemical composition. The result revealed presence of bioactive constituents comprising: *Aframomum melegueta* which has the highest protein and ash content of 7.18 % and 2.47% respectively. *Garcinia cola*, has the least content of all nutrients considered but highest in moisture. The plants are good sources of minerals such as Phosphorus, Potassium, Magnesium, Calcium, Zinc, Manganese, Iron, Sodium and Copper. Phytochemical analysis revealed are flavonoids (1.88 – 6.10mg/100g), saponins (12.00 – 1.23mg/100g), tannins (0.31-0.41 mg /100g), Alkaloids (0.40 – 0.30/100) and phenols (0.1-0.09mg/100g). The presence of these phytochemicals supports the use of these plants as antimicrobial agent. These components are responsible for their antioxidant, anticancer, antiviral, anti-inflammatory and anti-allergic activities and supports the popular use of *Garcinia cola* and *Aframomum melegueta* in herbal medicine in Nigeria.

Keywords: *Garcinia cola*, *Aframomum melegueta*, bioactive compounds, Anti-inflammatory, herbal medicine, phytochemical.

I. Introduction

Garcinia cola [Bitter kola] and *Aframomum melegueta* [alligator pepper] are traditional plants which are often eaten as snacks especially among the elderly in Nigeria. Bitter kola (*Garcinia cola*) is also known as Africa wonder nut. It comes from *Garcinia cola* trees, which belongs to the family harbaceae and grows in coastal rainforests in the south western and south eastern parts of Nigeria. Traditionally, these nuts were chewed as a masticalory substance, to stimulate the flow of saliva (1) but are now widely consumed as snack in West and Central Africa. The kernels of the nuts are widely traded and eaten as a stimulant (1,2). Bitter kola is also belived to be an aphrodisiac. Unlike other kolanuts however, bitter kola is believed to clean abdominal problems, when a lot of nuts are eaten (3). Extracts from the roots, barks seeds and fruit of these plants are used in the preparation of syrups and infusions in traditional medicine as cough suppressant and in the treatment of liver Garrhosis and hepatitis (4). In folk medicine, bitter kola is dried, ground and mixed with honey to make a traditional cough mixture. Alligator pepper (*Aframomum melegueta*) is a West Africa spice belonging to the plant family *Zingberaceae*. It is commonly known as guinea grains and is a close relative of the grain of paradise, which is obtained from the closely related species. *Aframomum melegueta* [alligator pepper] is sold as the entire pod containing the seed. *Aframomum melegueta* [alligator pepper] is a very popular spice used mainly as food, in brewing, and in veterinary and traditional medicine (5). It is also believed to have purgative and hemostatic properties and also to be very effective against schistomiasis (6). It is generally assumed that the active constituents contributing to these bioactive effects are the phytochemicals. (7). phytochemical are present in a variety of plants utilized as important components of both human and animal diet. These include fruits seeds herbs and vegetables Diets containing an abundance of fruits and vegetables are bioactive against a variety of diseases, particularly cardiovascular diseases (8). Phytochemical which promotes many ecological and physiological roles are widely distributed as plant constituents. Woodly plants can synthesize and accumulate in their cells a great variety of phytochemicals including Alkaloids, Flavonoids, Tannins, Cardiac glycosides, Phenolic compounds, and Saponins (9). This study revealed the fundamental scientific basis for the use of the seeds of these plants by determining the nutritional, mineral, and phytochemical composition present in the seed of *Garcinal kola* and *Aframomum melegueta*.

II. Materials and Method

Sampling and Sample Preparation

The *Garcinia cola* [Bitter kola] and *Aframomum melegueta* [alligator pepper] used were freshly harvested and purchased from local farmers at the Ila market in Osun State, Nigeria. The *Garcinia cola* [bitter kola] were wrapped in dry banana leaves (traditional method) for 3 weeks while the *Aframomum melegueta*

[alligator pepper] pods were also left to dry in the sun for a week. The dried seeds sample, were grounded using laboratory mortar and pestle kept in a polythene bag ready for analysis. seed of *Garcinia cola* and *Aframomum melegueta* were each weighed (1kg). the plant samples were sun dried and ground into uniform powder using masterchef blender and stored in airtight bottles till required analysis.

Nutritional Analysis

Standard methods of the Association of Official Analytical Chemist (10) were used to determine the moisture, crude protein, crude fat, total ash and crude fibre contents of the samples *Garcinia cola* and *Aframomum melegueta* (bitter kola and alligator pepper). Moisture content was determined by heating 2.0g of each sample to a constant weight in a crucible placed in an oven maintained at 105⁰C. The dry matter was used in the determination of the other parameters. Crude protein (% total nitrogen x 6.25) was also determined by the kjeldahl method, using 2.0g samples, crude fat were obtained by exhaustively extracting 5.0g of each sample in a soxhlet apparatus using petroleum boiling point range 40-60⁰C as the extract. Ash content was determined by the incineration of 10.0g samples placed in a muffle furnace maintained at 550⁰C for 5hrs. Crude fibre were obtained by digesting 2.0g of samples with H₂SO₄ and NaOH and incinerating the residue in a muffle furnace maintained at 550⁰C for 5hrs, total carbohydrate was obtained by different method, each analysis was carried out in two places.

Mineral Content Determination

The mineral contents of each sample were determined by atomic absorption spectrophotometry after dry ashing of the samples. Each ash sample was transferred quantitatively into a conical flask and dissolved in 10ml of 3% Ferric chloride and the mixture was heated on a hot plate. The solution was heated on a hot plate. The solution was then filtered into a 100ml volumetric flask and made up to the mark with distilled water. The mineral contents (Potassium, Calcium, Magnesium, Iron, Zinc, Manganese and Phosphorus) of the solution were determined using atomic absorption spectrometer.

Phytochemical Analysis

Phytochemical screening was carried out on the obtained plant extracts (11).

Quantitative Analysis of the Constituents

Test for Tannins

0.5g of the dried powdered samples *Garcinia cola* and *Aframomum melegueta* (bitter cola and alligator pepper) were boiled in 20ml of water in a separate test tube and then filtered. A few drop of 0.1% ferric chloride was added and observed for brownish green or blue black.

Test for Phlobatannin

An aqueous extract of the plant samples *Garcinia cola* and *Aframomum melegueta* me (bitter cola and alligator pepper) was boiled with 1% aqueous hydrochloric and deposition of a red precipitate was taken as evidence for the presence of phlobatannin.

Test for Saponins

2g of the powdered samples *Garcinia cola* and *Aframomum melegueta* (bitter cola and alligator pepper) was boiled in 20ml of distilled water in a water bath and filtered. 10ml of the filtrate was mixed with 5ml of distilled water and shaken vigorously for a stable resistant froth. The frothing was mixed with 3 drops of olive oil, shaken vigorously and then observed for the formation of emulsion.

Test for Flavonoids

5ml of 10% dilute ammonia solution was added to a portion of the aqueous filtrate of the plant extract, followed by addition of concentrated H₂SO₄. A yellow coloration observed in the extract indicated the presence of flavonoid.

Test for Cardiac Glycosides

5ml of the extract was treated with 2ml of glacial acetic acid containing 1 drop of ferric chloride solution (0.1%). This was underlaid with 1ml of concentrated H₂SO₄. A brown ring of the interface indicates deoxysugar characteristics of cardenolides. A violet ring may appear below the brown ring, while in the acetic layer, a greenish ring may form just gradually throughout thin layer.

Preparation of Fat Free Samples

2g of each sample were defatted with 100ml of diethyl ether using a soxhlet apparatus for 2hours.

Determination of Total Phenols by Spectrometer Method

For the extraction of the phenolic component, the fat free samples of each plants was boiled with 25ml of ether for 15 minutes. 2.5ml of the extract was pipette into a 25ml flask, and the 5ml of distilled water was added 1ml of ammonium hydroxide solution and 2.5ml of concentrated alcohol were also added. The samples

were left to react for 30 minutes for colour development. The absorbance of the solution was read using a spectrophotometer at 505nm wave lengths (12).

Alkaloid Determination using Harborne (1973) Method

2.5g of the samples were weighed into a 250ml beaker and 100ml of 20% acetic acid in ethanol was added and covered to stand for 4 hours. This was filtered and the extract was concentrated using a water bath to one quarter (1/4) of the original volume. Concentrated ammonium hydroxide was added to the whole solution, was allowed to settle and the precipitate was collected by filter. The residue is alkaloid, which was dried and weighed.

Tannin Determination by Van-Burden and Robinson Method (1981)

250g of the samples was weighed into 100ml plastic bottle 25ml of distilled water was added and shaken for 1hr in a mechanical shaker. This was filtered into a 50ml volumetric flask and made up to the mark. Then 5ml of the filtrate was pipette out into a tube and mixed with 3ml of Ferric chloride in 0.1M HCl and 0.08ml potassium ferrocyanide. The absorbance was measured in a spectrophotometer at 120nm wavelengths, within 10 minutes. A blank sample was prepared and the color also developed and was at the same wavelength. A standard was prepared using tannin acid to get 100ppm and measured (13).

Saponin Determination using Obadoni and Ochuko, 2001

20g of each ground plant samples were dispersed into 200ml conical flask contain 20% aqueous ethanol. The suspension was heated over a hot water bath for 4hrs with continuous stirring at about 55°C. The mixture was filtered and the residue was re-extracted with another 200ml of 20% ethanol. The combined extracts were reduced to 40ml over water bath at about 90°C. the concentrated was transferred into a 250ml separated funnel and 20ml of diethyl ether was added and shaken vigorously. The aqueous layer was recovered while the ether layer was discarded. The purification process was repeated by measured 60ml of n-butanol was added and combined n – butanol extracts were washed twice with 10ml of 5% aqueous sodium chloride (NaCl). The remaining solution was heated in a water bath. After evaporation, the samples were dried in a oven to a constant weight, and saponin content was determined.

Flavonoid Determination by the Method of Boham and Kocipcia by Ozam (1974)

100g of each plant samples were extracted repeatedly with 100ml of 80% aqueous methanol at room temperature. The whole solution was filtered through Whatman filter paper No.42 (125mm). The filtrate was later transferred into crucible and evaporated by dryness over water bath and weighed.

III. Results and Discussion

Table 1: Nutritional Composition (%) of *Garcinia kola* and *Aframomum melegueta*

<i>Constituents</i>	<i>Garcinia Kola</i>	<i>Aframomum melegueta</i>
Moisture	59.46±0.06	13.66±0.18
Dry Matter	39.63±0.05	84.50±0.17
Crude Fat	4.48±0.55	2.60±0.31
Crude Protein	2.48±0.10	7.20±0.05
Ash	0.88±0.006	2.50±0.08
Crude Fibre	5.01±0.15	5.54±0.13
Total Carbohydrates	27.69	31.50

Table 2: Mineral Composition of *Garcinia kola* and *Aframomum melegueta*

Mineral	<i>Garcinia Kola</i>	<i>Aframomum melegueta</i>
Magnesium	0.42±0.30	0.33±0.11
Calcium	1.80±0.40	0.26±0.20
Potassium	2.50±0.10	0.65±0.01
Phosphorous	0.33±0.10	1.60±0.22
Sodium	0.72±0.10	0.45±0.02
Iron	17.75±0.30	1.80±0.02

Zinc	2.30±0.01	0.02±0.11
Manganese	0.78±0.20	0.63±0.22
Copper	2.01±0.50	0.17±0.10
Chromium	0.00	0.00
Cobalt	0.55±0.20	0.00
Cadmium	0.29±0.10	0.00

Results are means values ± standard deviation of two places determinations.

Table 3: Phytochemical Constituents of the Seeds of *Garcinia cola* and *Aframomum melegueta*

Constituents	<i>Garcinia cola</i>	<i>Aframomum melegueta</i>
Tannin	+	+
Saponin	+	+
Steroid	+	+
Terpernoids	+	+
Cardiac glucoside	+	+
Alkanoid	+	+
Phlobatannins	-	-

Key : + indicate present, - indicate Not present.

Table 4: Phytochemical Composition of *Garcinia cola* and *Aframomum melegueta* on dry weight basis expressed as mg/100⁻¹ g.

Constituents	<i>Garcinia cola</i>	<i>Aframomum melegueta</i>
Phenols	0.1 ± 0.20	0.09 ± 0.10
Alkanoids	0.40 ± 0.10	0.30 ± 0.20
Tannins	0.31 ± 0.20	0.41 ± 0.11
Saponins	12.00 ± 0.10	1.23 ± 0.30
Flavonoids	1.88 ± 0.20	6.10 ± 0.10

Results are mean of live determination dry weight basis ± standard deviation.

IV. Results

The nutritional composition of *Garcinia cola* [bitter kola] and *Aframomum melegueta* [alligator pepper] are shown

Table 1. *Garcinia cola* contain highest amount of moisture while *Aframomum melegueta* has the least amount of moisture. Quantitative estimates of other nutritional fat, solid matter, ash, protein and crude fibre were also detected in both seeds.

The results of the mineral composition showed that *Garcinia cola* and *Aframomum melegueta* seeds constitute a rich source of mineral elements. Calcium was the most abundant element available in *Garcinia cola* seed (1.80mg100⁻¹g), followed by potassium(2.50mg100⁻¹g) while *Aframomum melegueta* contain 0.26mg100⁻¹g of calcium and 0.65mg100⁻¹g of potassium, phosphorus, magnesium and sodium were detected in both seed. Enormous quantity of iron (17.75mg100⁻¹g) and zinc (2.30mg100⁻¹g) were detected in *Garcinia cola* seed while *Aframomum melegueta* contained 1.80mg100⁻¹g and 0.02mg100⁻¹g of Iron and Zinc respectively. Copper, Manganese and Cobalt were available in *Garcinia cola* seed while Chromium was not detected in *Garcinia cola* and *Aframomum melegueta* seeds (Table 2).

Table 3; indicates the phytochemical composition of *Garcinia cola* and *Aframomum melegueta* which reveal the presence of Tannin, Saponin, Flavonoid, Steroid, Terpernoids, Cardiac glycoside, Alkaloids and Phenol while absence of Phlobatannins in both seeds.

The phytochemical constituents of the seeds of *Garcinia cola* and *Aframomum melegueta* on dry weight basis are shown in table 4. The concentration of Saponin was higher in *Garcinia cola* (12.00mg100⁻¹g) than in *Aframomum melegueta* which contain (1.23mg¹⁰⁰⁻¹g). *Aframomum melegueta* contained more Flavoniod (6.10mg¹⁰⁰⁻¹) and Tannin (0.31mg¹⁰⁰⁻¹g) while *Garcinia cola* contained 1.88mg¹⁰⁰⁻¹g of Flavoniods and 0.31mg¹⁰⁰⁻¹g of tannins respectively.

Quantitative estimates of other phytochemicals shows that *Garcinia cola* contained 0.40mg¹⁰⁰⁻¹g of Alkaloids *Aframomum melegueta* contained 0.30mg¹⁰⁰⁻¹g of Alkaloids. Phenol were detected in *Garcinia cola* are higher (0.10mg¹⁰⁰⁻¹g) than *Aframomum melegueta* which contain least Phenol (0.10mg¹⁰⁰⁻¹g).

V. Discussion

The result of nutritional composition (presented a table 1) shows that *Aframomum melegueta* has the least amount of moisture. Since, it is sample subjected to drying before consumption, unlike the other nuts that are prevented from losing moisture by wrapping them in fresh banana leaves. Consequently, *Aframomum melegueta* has the highest solid matter also appears to be the most nutritious of the traditional snacks having 7.20% protein and 2.50% ash which can be used in treating the obesity (14).

The nutrients composition of ash, protein and crude fibres contents were obtained in the *Garcinia cola* (2.48%, 0.88% and 5.01% respectively). These values are different from what had previously reported for *Garcinia cola*. (15) reported a protein content of 2.48%, liquid 4.51%, ash of 0.79% and crude fibres content of 5.23% in the seed.

The varying composition reported by various these snacks vary with season, environment and condition or time evaluation.

The results of the mineral composition clearly indicate that *Garcinia cola* and *Aframomum melegueta* seeds contain rich source of mineral elements. This becomes important when the usefulness of such mineral like Phosphorus, Calcium, Magnesium, Potassium, Iron and Zinc in the body considered. The Zinc content could mean that the plants can play a valuable role in the management of diabetes, which results from insulin malfunctioning. Zinc is essential for the production of insulin, a hormone and carbonic anhydrase, an enzyme in the body (9). Iron is a component of hemoglobin. It helps oxygen transport. Iron together with hemoglobin and ferrodizin plays important role in man's metabolism (9).

However, the lower sodium content of *Garcinia cola* and *Aframomum melegueta* might be an added advantage due to the direct relationship of sodium intake with hypertension in human (16).

Aframomum melegueta and *Garcinia cola* seeds are rich in phytonutrient such as Flavonoids, Phenolic compound, Tannins, Saponin, Terpernoids, cardiac glycosides and Alkaloids.

The biological function of flavonoids protection against platelet ulcers, viruses, and tumors (9). This may be the reason behind the use of extracts of this plant in the treatment of intestinal troubles in herbal medicine (9), the presence of phenolic compounds in the seed of *Aframomum melegueta* and *Garcinia cola* indicates that this plant might be an antimicrobial agent. This is because Phenols and Phenolic compounds have been extensively used in disinfection and remain the standard with which other bactericides are compared. Phenolic compounds as electron donors are readily oxidized to form Phenolate ion or quinone, an electron acceptor. This gives rise to practical uses. Protonated Phenol is used as cleaning agent. Extracts from *Aframomium melegueta* and *Garcinia cola* therefore have potent bactericidal properties (9). These findings supported the use of extract from *Garcinia cola* and *Aframomum melegueta* in preventing the formation of wound infections and also in treating wounds that not only heals fast (9).

The presence of Phenol further indicated that the seed of *Garcinia cola* and *Aframomum melegueta* could act as anti-inflammatory, ant clotting and immune enhancers. Phenols have been the subjects of extensive research as disease preventatives (17). Phenols have been responsible in having the ability to block specific enzymes that causes inflammation.

Garcinia cola and *Aframomum melegueta* seeds have high quality of Saponin content. Some of the general characteristics of Saponin include formation of foams in aqueous solution; cholesterol binding properties and bitterness (18).

Apart from Saponin, other secondary metabolite constituents of *Garcinia cola* and *Aframomum melegueta* detected include the Alkaloids and Tannins. Alkaloids ranked the most efficient therapeutically significant plant substance. Pure isolated plant Alkaloids and their synthetic derivatives are used as basic medicinal agents for their analgesic and bactericidal effects (19). They exhibit marked physiological activity when administered to animals. The high Tannin content could be partly responsible for the bitter principle associated with the raw seeds of *Garcinia cola* and hot, bitter and pungency of *Aframomum melegueta* seed. Tannins have a stringent properties, hasten the healing of wounds and inflamed mucous membrane (9). The presence of Tannins *Aframomum melegueta* and *Garcinia cola* strongly supports their use in treating wounds, hemorrhoids and burns in herbal medicine (20).

The present study has verified the usefulness of *Garcinia cola* and *Aframomum melegueta* seeds for nutritional and medicinal purpose. This partly explained the use of these plant materials in herbal medicine. As rich source of phytochemicals couple with the presence of the essential vitamins and minerals. *Garcinia cola* and *Aframomum melegueta* seeds can be seen as a potential source of useful foods and drugs formulation. The uses of these plants for the treatment of the disease as claimed by traditional healer are also being investigated.

VI. Conclusion

Conclusively, one can conclude that from the results of the nutrient and mineral composition *Aframomum melegueta* is the most nutritious of the two 'snacks' investigated except for a few minerals that are absent in it.

Garcinia cola and *Aframomum melegueta* can be of immense use in phytomedicine and can be included in health care delivery system particularly in the developing economics. It can be concluded from this reports that the extracts from the seeds of *Garcinia cola* and *Aframomum melegueta* revealed the presence of phytochemical supports its uses as antimicrobial agent.

VII. Recommendation

Garcinia cola [Bitter kola] can be recommended in folk medicine with honey mixed to make a traditional cough mixture, without any mixed it can also be used as an appetizer when there is indigestive. While the *Aframomum melegueta* [alligator pepper its can be used to cure *Schistosomiasis japonicon*, *Schistosomiasis masomani*.

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