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Physico-Chemical and Nutritive Properties of Bitter Kola (*Garcinia Kola*)

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Abstract

This study evaluated the proximate composition, nutritive properties and phytochemical content of Bitter Kola. Colour, shape, texture, odour, flavour and colour of peeled seed were some of the physical properties observed. Carbohydrate (70.31%) was observed to be the most abundant biological molecule. The moisture content (9.28%) was significantly high (P<0.05) while Ash (4.17%), crude fiber (3.94%) ether extract/fat (1.03%) and crude protein (11.27%) were present in appreciable amounts. Vitamins A, C, E, B1, B2, B3 contents of the bitter kola were assayed. The mineral and phyto-chemical analysis revealed the nutritional and medicinal values of Bitter Kola. The levels of vitamin C, calcium, potassium and iron were significantly high (P<0.05). The phyto-chemical assay showed that tannin (0.347%), sapoium (0.680%), phytic acid (0.550%), phenol (0.163%), Trypsin inhibitor (2.737Tu/g), sterol (0.093%), flavonoid (2.130%), Alkaloid (0.433%), oxalate (0.433%), caffeine (0.607%) and Hydrogen cyanide (1.347 mg/kg) were present in significant amounts. These results suggest that Bitter Kola possess nutritional and healthy benefits.

Keywords: Physicio-chemical; Nutritive properties; Bitter Kola *(Garcinia Kola)*

Introduction

Bitter Kola *(Garcinia Kola)* is popular in Southern Nigeria. The plant is extensively used in herbal medicine and as food. It prevails as a multipurpose tree crop in the home gardens of Southern Nigeria [1].

The seeds of *Garcinia Kola* is chewed as an aphrodisiac or used to cure cough, dysentery, or chest colds [2]. It could serve as raw material for pharmaceutical industries [3]. The raw stem bark of *Garcinia Kola* is a purgative. The powdered bark is applied to malignant tumors. The sap is used for curing parasitic skin diseases. The latex or gum is used internally against gonorrhea, and applied externally on fresh wounds. The seeds prevent or relieve colic disorders or cure head or chest colds, suppressed cough and is often used in the treatment of Cirrhosis and hepatitis (inflammation of the liver) [4].

An important constituent of *Garcinia Kola* is flavonoid having anti-inflammatory properties [5] and a natural antioxidant [6]. Industrially, *Garcinia Kola* is being investigated for possible hop substitution in bear production. The bitterness and microbial actions were suspected to be as a result of the presence of some phonelic compounds [7].

Consumption and use of bitter kola in Nigeria is low due to inadequate information on the physico-chemical and nutritive properties. Consequently, it becomes imperative to investigate this seed and create awareness on its potentials.

Materials and Methods

Sample collection and preparation

Samples of *Garcinia Kola* seeds were purchased from Umuahia Main market, Abia State, Nigeria. The wholesome seeds were peeled manually to remove the brown seed coat. The peeled seeds were adequately dried in an oven at 50°C and milled. The milled samples were packaged in sterile screw capped sample bottles and stored at ambient temperature for analysis.

Proximate analysis

Total Ash was determined by the furnace incineration gravimetric method [8]. Fat, crude fibre, protein and moisture content of the bitter kola samples were determined by the method described by James [9]. The Kjeldahl method was used to determine crude protein as total nitrogen and multiplied by a factor of 6.25. Fat was extracted by the solvent extraction method using 300 ml of petroleum ether. Moisture content was determined by the gravimetric method while crude fiber was determined by the Wende method (James, 1995) [9] by treating each defatted sample with 1.25% H_2S0_4 and 1.25% NaOH under reflux for 30 minutes.

The treated samples were dried in an oven (Gallen Kamp, Germany) at 105°C for 3 hours before incinerating subsequently in a muffle furnance at 550°C for 2 hours. The carbohydrate content was estimated by difference and expressed as the nitrogen free extracts [9].

Determination of vitamins and minerals

Vitamins A, C, and E were determined by the method described by Kirk and Sawyer [10]. The B-vitamins (B_1, B_2 and B_3) were determined by the Skalar colorimetric method as described by Okwu and Josiah, 2006. The mineral content was determined using the dry Ash extraction method [9]. The minerals investigated were phosphorus, calcium, magnesium, potassium, sodium and Iron. Potassium and sodium were determined using Jaway digital flame photometer [11] while iron was determined using the Spectrophotometric method [12].

Determination of phytochemical

Alkaloids, Saponin and Flavonoid were determined by the gravimetric method described by Harborne, 1973 [13], respectively while Oxalate, Tannin and Phenol were assayed using the Folin Dennis spectrophotometric method as described by Kirk and Sawyer [10],

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respectively. Hydrogen cyanide and Phytic acid were determined by the method described by Onwuka [14]. Caffeine was determined by the method described by Abdul et al. while Trypsin inhibitor was determined by the method of Arntfield et al. [15]. Total Titratable Acidity (TTA) was determined by the AOAC method while P^H was determined using P^H meter as described by Baraket et al. [16].

Statistical analysis

All data were reported as means of triplicates. Analysis of variance (ANOVA) was used to establish significant difference ($P<0.05$) and means separated by Duncan multiple Range test [17].

Results and Discussions

High moisture content in any food product can make it viable to microbial attack and this account for most biochemical and physiological reactions in plant foods [18]. Crude protein has been proven to be essential for the survival of humans and other animals [19]. The Bitter Kola seed contains a considerable amount of protein (11.27%) (Table 1).

Carbohydrate (70.31%) was observed to be the most abundant biological molecule. Carbohydrate plays important roles in the body as a source of energy [19]. It provides accessible fuel for physical performance and regulates nerve tissue [20].

Other components present in the bitter Kola but in minute quantities are Ash (4.173%), crude fiber (3.940%) and ether extract (1.030%) (Table 2).

Vitamin B_1 (Thiamine) is involved in the metabolism of keto acids and carbohydrates. Its deficiency results in the loss of appetite, nausea, constipation, irritability, tiredness and development of cardiac difficulties (Table 3). Vitamin C is a potent antioxidant that combats infections and help in formation of collagen; it is needed for development of strong bones, teeth and joints [21].

Parameters	Observation
Colour	Yellow Pulp and brown seed coat
Colour of peeled seed	Milky
Shape	Elliptical/Oval
Texture	Hard
Odour	Slightly Aromatic
Flavour	Bitter

Table 1: Physical Properties of Bitter Kola Seed.

tParameters (%)	Results
Moisture	9.280 ± 0.6928
Ash	4.173 ± 0.0116
Crude fibre	3.940 ± 0.0000
Ether extract (fat)	1.030 ± 0.0173
Crude protein	11.27 ± 0.0306
Carbohydrate	70.31 ± 0.0755
TTA (%)	0.6167
PH	5.72

± Standard deviation of three replicates

Table 2: Proximate Composition, P^H and Total titratable acidity of Bitter kola seed.

Parameters	Results
Vitamin B_1 (thiamine) (%)	0.6433 ± 0.01155
Vitamin B_2 (Riboflavin) (%)	0.2767 ± 0.01155
Vitamin B_3 (Niacin) (%)	1.6800 ± 0.0000
Vitamin C (Ascorbic Acid) (mg/100g)	12.6333 ± 0.01155
Vitamin E (Tocopherol) (mg/100g)	2.5400 ± 0.00000
Vitamin A (Retinol) (mg/g)	1.3600 ± 0.0000
Phosporus (%)	0.3800 ± 0.00000
Calcium (%)	1.8333 ± 0.01155
Magnesium (%)	0.4433 ± 0.01155
Potassium (%)	2.7367 ± 0.00577
Sodium (%)	0.7533 ± 0.01155
Iron (%)	3.5067 ± 0.02309

± Standard deviation of three replicates

Table 3: Vitamins and Mineral Composition of Bitter Kola.

Phytochemicals	Results
Tannin (%)	0.3467 ± 0.01155
Saponin (%)	0.6800 ± 0.00000
Phytic Acid (%)	0.5500 ± 0.01732
Phenol (%)	0.1633 ± 0.00577
Trypsin Inhibitor (Tu/g)	2.7367 ± 0.00577
Sterol (%)	0.0933 ± 0.00577
Flavonoid (%)	2.1300 ± 0.06083
Alkaloid (%)	0.4333 ± 0.01528
Oxalate (%)	0.4333 ± 0.01528
Caffeine (%)	0.6067 ± 0.01528
Hydrogen Cyanide (mg/kg)	1.3467 ± 0.01157

± Standard deviation of three replicates

Table 4: Phytochemical Composition of Bitter Kola.

Vitamin C is involved in the activities and functions of all cells. It promotes the absorption of iron, boosts immune system, neutralizes blood toxins, helps in maintaining the epithelial tissues of the skin and connective tissues and has many other physiological functions. It is required for the maintenance of healthy gums for healing of wounds and mopping up excess oxygen from the tissue [21].

Vitamin E (Tocopherol) is found in a number of animal and plant product. Tocopherols are important antioxidant in foods especially vegetable oils. The most important physiological function of tocopherol is the inhibition of the oxidation of unsaturated fatty acids in tissues. It helps to maintain healthy cells, protects unsaturated fatty acids and vitamin A against oxidation [21].

Riboflavin is a co-enzyme involved in the metabolism of carbohydrates and proteins. Its deficiency leads to blurred vision and intolerance of light. Niacin is involved in glycolysis, fat synthesis and tissue respiration. Vitamin A is involved in the formation of epithelial issues for proper maintenance and growth of bones and reproduction and for good vision, healthy skin, hair and nails [21].

Sodium and potassium are required to maintain osmotic balance of body fluid, the P^H, regulation of muscles and nerve irritability, control glucose absorption and enhance normal retention of protein during growth [22]. Phytochemicals are biologically active compounds found in plants in small amounts, which are not established nutrient but which nevertheless contribute significantly to protecting the body against degenerative diseases (Table 4).

Flavonoids are potent water-soluble super antioxidants and free radical scavengers which prevent oxidative cell damage, have strong anti-cancer activity and protects against all stages of carcinogenesis [23]. Adesuyi et al. reported that flavonoids have protective effects including anti-inflammatory, antioxidant, antiviral and anti-carcinogenic properties.

Phenols are useful antiseptic used in manufacturing of resins, plastics, insecticides, explosive, dyes and detergents and as raw materials for production of drugs.

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