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: Physico-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 are 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 beer 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% H2SO4 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 furnace 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 (B1, B2 and B3) 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 Owunna [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^m was determined using P^m 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, (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].

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^m, 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.

**References**