

Phytochemical and Physicochemical Properties of Leaf, Stem and Flowers of *Luffa Aegyptiaca* (Johann Veslingius)

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Abstract

The leaf, stem and flowers of *Luffa aegyptiaca* were screened for their phytochemical and physicochemical properties. The phytochemical evaluation of the leaf, stem and flowers revealed the presence of saponins, tannins and cardiac glycosides. Alkaloids were only present in the flowers. Cyanogenetic glycosides and phlobatannin were absent in the leaf and stem respectively. The nutrient value shows that the leaves contain 10.01% of moisture, 0.78% of crude protein, 2.40% of lipids, 14.61% of crude fibre, 3.65% of ash and 48.02% of carbohydrate. The stem contain 7.02% of moisture, 3.01% of crude protein, 4.50% of lipids, 8.10% of crude fibre, 2.50% of ash and 61% of carbohydrate. While the flowers contain 4.01% of moisture, 0.5% of crude protein, 5.1% of lipids, 7.01% of crude fibre, 1.5% of ash and 45.1% of carbohydrate. These findings prove that *Luffa aegyptiaca* contains bioactive compounds that may be useful in nutrition and explains its popular use in traditional medicine in Nigeria.

Keywords: *Luffa aegyptiaca*; Phytochemical; Nutrient; Antinutrient; Leaf; Stem and flowers.



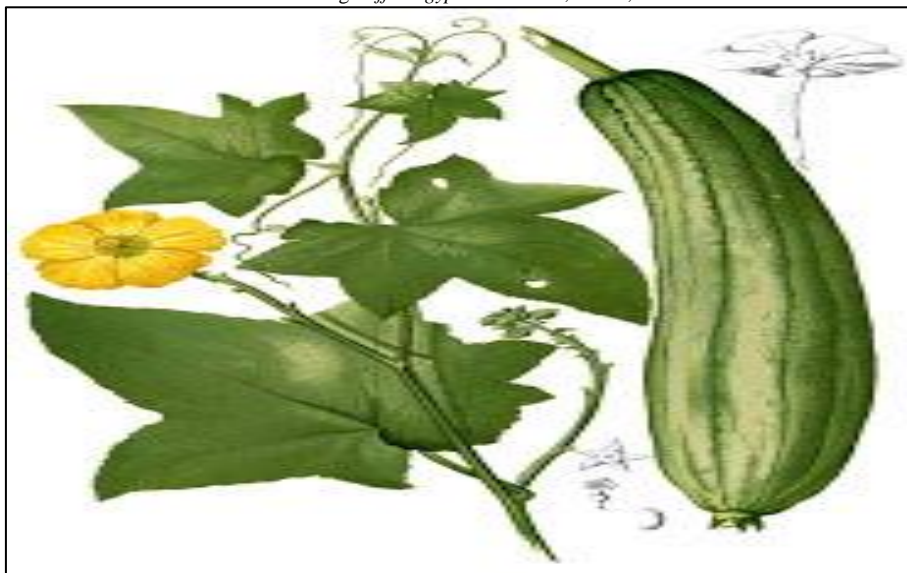
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1. Introduction

Medicinal plants have been known for millennia and are highly esteemed all over the world as a rich source of therapeutic agents for the prevention of diseases and ailments [1]. The Chemical constituents present in the medicinal plant are a part of the physiological functions of living flora and hence they believe to have better compatibility with human body. The use of bioactive plant derived compounds are on the rise because of the main preoccupation with the use of synthetic drugs is the side effect which can be even more dangerous than the disease they claim to cure. Whereas plant derived medicines are based on the premise they contain natural substances that can promote health and alleviate illness and prove to be safe; better patient tolerance, relatively less expensive and globally competitive. *Luffa* is a genus of tropical and subtropical vines classified in the cucumber family called Cucurbitaceae which is also known as gourd family. The gourd family of flowering plants, belonging to the order Cucurbitales contains 118 genera and 845 species of food and ornamental plants. It includes the gourds, melon, squashes and pumpkins. Most species are prostrate or climb by-tendrils. They are annual or perennial herbs native to temperate and tropical areas. The family includes such economically important food plants as pumpkin, cucumber, gherkin, water melon, muskmelon, charyote, summer squash, winter squash, cassabahana and gourds. Cucurbits have generally low nutrient content except winter squash [2].

Most species have unisexual flowers which are borne in the left axils and have five (5) white or yellow petals. There are five sepals in each flower, male flowers have up to five (5) anthers, often fused or joined in a complex way and female flowers usually have three (3) carpels. The fruits are fleshy, many seeded being with a tough rind, often attaining considerable size [3]. The seeds are flattened and sometimes have beautiful wings. The female flowers have inferior ovaries. The leaves are extipulate, alternate and simple palmately lobed. Flowers are unisexual. The stem is hairy and pentangular at 90° to the leaf petiole at the node [4].

Luffa fruits are eaten as food when they are still young and green. In Vietnam, it is used as a common ingredient in soup and stir fried dishes. It is mostly used as vegetable in curries, but also as a snack, bhajji, dipped in chick pea butter and deep fried. It is used widely in steaming glutinous rice instead of cloth. In addition to immature fruits, the Chinese also eat young shoots, leaves and flower buds. The raw flowers are nice addition to tossed salads. The plant is bitter tonic, emetic, diuretic and purgative and useful in asthma, skin diseases and splenic enlargement. It is used internally for rheumatism, backache, internal hemorrhage, chest pain as well as hemorrhoids. It is used externally for shingles and boils. The dried fruits fibers are used as abrasive sponges in skin care, to remove dead skin and to stimulate the circulation [2, 3].

Plate-1. Plant Showing *Luffa aegyptiaca* Leaves, Stems, Flower and fruit

2. Materials and Methods

2.1. Collection and Identification of Plants

The plant materials were collected at two different locations in Akwa Ibom State. The Fresh leaves and stems of *Luffa aegyptiaca* were collected from Itak – Ikono Local Government Area on the 11th of November, 2014 while the fresh flowers were collected from University of Uyo town campus by Cynthia Anyasodor on the 7th of December, 2014 and Authenticated by Prof. (Mrs.) U. Essiett, a taxonomist in the Department of Botany and Ecological Studies, University of Uyo, Uyo.

2.2. Phytochemical Screening

Fifty grammes (50g) weight of the leaves, stem and flowers respectively were dried under the sun and ground into uniform powder using mortar and pestle. The ground leaves, stem and flowers were macerated in extraction tanks with 50% ethanol for 72 hours respectively. The crude extracts were separated by filtration and concentrated in Vacuum at 40^oC to obtain dry ethanolic extract. Basic phytochemical screening consists of performing simple chemical test to detect the presence of useful chemical and bioactive constituents it includes, Alkaloids, Tannins, Saponins, anthraquinones, flavonoids etc. The method of Trease and Evans Sofowora [5] and Sofowora British Pharmacopoeia [6] was used.

2.3. Quantitative Microscopy/Proximate Analysis

The moisture content of the powdered leaves was determined loss on drying method. Essiett and Akpabio [7] The ash value, acid insoluble ash, water-soluble ash and sulphated ash were determined as described by British Pharmacopoeia [8], African Pharmacopoeia [9]. The water and alcohol extractive values were obtained using the method outlined by Brain and Tuner Pearson [10], British Pharmacopoeia [8]. The fat (lipids), crude protein, crude fibre and carbohydrate were obtained using the method outlined by Pearson Okon [11], Okon AOAC [12] and AOAC Essiett and Akpabio [7].

3. Results

The result of the phytochemical screening of the leaves, stem and flowers of *Luffa aegyptiaca* reveals the presence of saponin, tannins, and cardiac glycoside in all the three parts of *Luffa aegyptiaca*. Cardiac glycoside (Salkowski test) was abundantly present in the leaves, moderately present in the stem and trace in the flowers. Killer Killiani Test revealed that cardiac glycoside was moderately present in the leaves, but abundantly present in stem and flowers. Lieberman's Test shows that glycosides are abundantly present in the leaves and flowers but moderately present in the stem. Alkaloids was completely absent in the leaves and stem but abundantly present in the flowers. Terpenes were in traces in the flower and stem and absent in the leaf. Flavonoids were moderately present in the leaves and abundantly present in the flowers but absent in the stems. However anthraquinone was present in the stem in trace amount. Phlobatannin and cyanogenetic glycosides were completely absent in all the three parts of *Luffa aegyptiaca* present. The result of the proximate analysis of the leaves, stem and flower of *Luffa aegyptiaca* in percentage are as follows; moisture content 10.01, 7.02, 4.01 respectively, crude protein 0.78, 3.01, 0.5 respectively. Lipids 2.40, 4.50, 5.1 respectively. Crude fibre 14.01, 8.10, 7.01 respectively. Ash 3.65, 2.50, 1.5 respectively, carbohydrate 48.02, 61.01, 45.1 respectively.

The anti-nutritional analysis of the leaf, stem, and flowers of *Luffa aegyptiaca* result in mg/100g were Hydrocyanide 10.03, 14.01, 15.01 respectively, Total Oxalate 22.01, 32.01, 22.01 respectively. Soluble Oxalate 15.01, 28.01, 10.01 respectively. Tannins 145.05, 167, 149.01 respectively. Phytic acid 90.10, 70.01, 60.01 respectively. Nitrogen 41500, 211200, 15000 respectively.

Table-1. Results of Phytochemical Properties of *Luffa aegyptiaca*

Metabolites	Inferences		
	Leaves	Stem	Flower
Alkaloids	ND	ND	+++
Flavonoids	++	ND	+++
Saponins	+++	++	+++
Tannins	+++	+++	+
Terpenes	ND	+	+
Anthraquinones	ND	+	ND
Cardiac glycosides			
i. Salkowski Test	+++	++	+
ii. Keller Killiani	++	+++	+++
iii. Leberman's Test	+++	+++	+++
Phlobatanin			
Cyanogenetic glycoside	ND	ND	ND

Key: ND = Not Detected, + = Trace, ++ = Moderately present, +++ = abundantly present

Table-2. Result of Quantitative Determination of Phytochemicals in percentage (%)

Parameters	Leaf	Stem	Flowers
Saponins	11.02	13.95	20.55
Tannins	0.00	14.67	3.00
Flavonoids	0.00	0.00	1.05
Alkaloids	0.00	0.00	22.50

Mean of an average triplicates

Table-3. Result of Proximate Nutrient and Analysis (%)

Sample Nutrient	Leaf	Stem	Flower
Moisture	10.01	7.02	4.01
Crude protein	0.78	3.01	0.5
Lipids	2.40	4.50	5.1
Crude fibre	14.01	8.10	7.01
Ash	3.65	2.50	1.5
Carbohydrate	48.02	61.01	45.1

Each data is a mean of triplicate determination

Table-4. Anti-Nutrient-Result mg/100g (concentration)

Anti-Nutrient Sample	Leaf	Stem	Flower
Hydrogen Cyanide	10.03	14.01	15.01
Total Oxalate	22.01	32.01	22.01
Soluble Oxalate	15.01	28.01	10.01
Tannins	145.05	167	149.01
Phytic Acid	90.10	70.01	60.01
Nitrogen	41500	211200	15000

Table-5. Extractives (%)

Parameters	Leaf	Stem	Flowers
Sulphated Ash	1.040	0.05	0.25
Acid Insoluble	0.002	0.05	0.02
Non Volatile	4.00	2.50	0.05
Volatile	2.10	1.40	0.5
Alcohol Absolute	25.33	20.33	10
Dilute Alcohol	35.33	40.33	15
Aqueous	46.33	40.33	22

Mean of an average of triplicates

4. Discussion

From the result obtained in the qualitative phytochemical screening and quantitative estimation of the percentage crude yields of chemical constituents of plants parts studied showed Alkaloids were completely absent in the leaves and stem of *Luffa aegyptiaca* but abundant in the flower. The leaves, stem and flowers of *Luffa aegyptiaca* is found to be rich in Tannins and Saponins, which were known to show medicinal activity as well as exhibiting physiological activity.

The presence of flavonoids suggests, that the plant might induce mechanism that affect cancer cells and inhibit tumor invasion [13]. Essiett and Akpabio [14] reported that many plants containing flavonoids are diuretic and are antioxidant. The leaves and flowers of *Luffa* can equally be applied in each case.

Saponins were strongly present in the three parts. Saponins are responsible for anti-oxidants properties. It also protects the plant against microbes and fungi [15]. Although Saponins are haemolytic on red blood cells. Terpenes which were also present in the stem and flowers show that the plant is a rich source of essential oil. Essential oil can be used as natural flavour additives for food, as fragrance in perfumery and in traditional and alternative medicine such as aromatherapy. The presence of anthraquinone in trace amount in the stem suggests that the plant have antioxidant, antiviral, anti-malaria, laxative analgesic, anti-microbial and anti-tumor activities [16].

Proximate nutrient analysis show that the high moisture level of dry *Luffa aegyptiaca* leaves, stem, and flowers is susceptible to microbial growth, also the level of protein, ash fibre and lipids is as a result of its moisture content. The protein content of *Luffa aegyptiaca* leaf, stem and flowers are 0.78, 3.01 and 0.5 respectively and contributes to the formation of hormones which controls the variety of body functions such as growth repairs and maintenance of body protein.

The high level of carbohydrate in the extract can be ranked as a carbohydrate rich food when compared to other levels of nutrients. However, the low level of protein and the high level of carbohydrate shows that it can form part of human diet. *Luffa aegyptiaca* leaves, stem and flowers were found to have crude fat content of 2.40, 4.50 and 5.1 respectively. The low level of fat also shows that the vegetable is not a source of lipid accumulation which can cause arteriosclerosis; hence the extract will be good for individuals suffering from or prone to disease of the cardiovascular system [17].

The fibre content in the leaves, stems and flowers are 14.01, 8.01 and 7.01 respectively. Crude fibre in the body contributes to weight, bulk and softness of faecal matter, allowing it to move through the gastro intestinal tract with ease. As a result, it prevents constipation. It also reduces the occurrence of coronary heart diseases. The Ash content of leaves, stems and flowers were relatively low. The Acid insoluble ash value (%) of *Luffa aegyptiaca* leaves, stems and flowers were very minutes. This implies that a large portion of ash content is acid insoluble and hence may be physiologically important as salt in the body when consumed [18].

The Ash content of leaves, stems and flowers were 3.65, 2.50 and 1.5 in percentage respectively. However, the presence of ash is an indication of mineral content in *Luffa aegyptiaca* leaves, stems and flowers. The Acid insoluble ash value (%) of *Luffa aegyptiaca* leaves, stems and flowers were very low. It is also an indication of high digestibility of the plant when eaten [19]. Sulphated ash value (%) of *Luffa aegyptiaca* leaves, stem and flowers were found in trace amount. This shows that the three parts extracts are moderately pure. Thus sulphated ash is a good criterion used to judge the identity of purity. The hydrogen cyanide, total oxalate, phytate contents and tannic acid of the leaves stem and flowers were high. In leaves, stem and flowers. Tannin is known to be bitter and form high polyphenol complex with protein thereby making it unavailable in the diet [19]. Tannin may decrease protein quality by decreasing digestibility and palatability. Oxalates are regarded as undesirable constituents of the diet, reducing assimilation of calcium, flavouring the formation of renal calculi [18]. However, the study revealed that the plant studied here can also serve as a potential source of useful drugs.

5. Conclusion

The phytochemical screening of *Luffa aegyptiaca* leaf, stem and flowers reveals the presence of pharmacological active compounds such as saponin, cardiac glycosides, flavonoids, tannins and anthraquinones. In trace, this result suggests that the plant may be of high medicinal value. Nutritionally, the plants are found to contain high amount of carbohydrate and small quantity of other food nutrients such as protein, lipids, ash and crude fibre. This indicates that the plant can be eaten as food supplement. All the anti-nutrient compounds are contained in toxic amounts. For instance, the recommended daily intake of hydrogen cyanide is 8mg/100g. So anything higher than this will be toxic to the body. This plant can still be edible when subjected to cooking. This is because 99% of the cyanogenic glycosides are lost when cooked, thus toxicity is virtually removed.

Recommendations

Luffa aegyptiaca should be recommended for consumption in spite of the high content of toxic level of anti-nutrient, since it is usually cooked. More research should be carried out on *Luffa aegyptiaca* for verification and justification of their medicinal values. Also, pharmaceutical companies and other agencies should encourage research into *Luffa aegyptiaca* to see how they can unfold their medicinal values by using it to produce drugs for people.

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