*Recent Research in Science and Technology 2010, 2(1): 63–68*
*ISSN: 2076-5061*
*www.recent-science.com*

ETHNOMEDICINE, PHARMACY & PHARMACOLOGY

# PHARMACEUTICAL AND THERAPEUTIC POTENTIAL OF SOME WILD CUCURBITACEAE SPECIES FROM SOUTH – EAST NIGERIA

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## Abstract
The phytochemical screening of some wild Cucurbitaceae species from South – East Nigeria, was investigated to determine their pharmaceutical and Therapeutic potential. The four plant species used for the study were *Lagenaria vulgaris*, *Trichosanthes cucumerina*, *Momordica charantia* and *Luffa cylinderical*. The leaves, pericarp and seeds of the plants were investigated. Alkaloids, flavonoids, phenols, saponin and tannins were found in all the plant parts analyzed and in all the plant species. Averagely, the phytochemical constituent of the plants are as follows: alkaloid (0.02- 0.07 mg $ml^{-1}$), flavonoid (0.05- 0.12 mg $ml^{-1}$), phenol (0.077- 0.978 mg $ml^{-1}$), saponin (0.04- 0.08 mg $ml^{-1}$) and tannin (0.283- 0.982 mg $ml^{-1}$). The leaves of the plants have the highest amount of tannins and phenols, while the seeds contain the highest concentration of alkaloids and flavonoids. The least amount of saponin was found in the seeds of the plants. The results obtained were discussed in respect to the roles of the plants and their phytochemicals in maintenance of good health.

**Key Words**: Phytochemicals; Cucurbitaceae; pharmaceutical; Medicinal plants.

## Introduction

Cucurbitaceae the gourd family includes hundreds of species of vines with coiled climbing tendrils and some of the most unusual fruits in the world[1] Members of this family are known to be very useful, serving as food, ornamental purposes, utensils, fuel and medicinal purposes[2;3;4].

In Nigeria, indigenous people traditionally use a wide range of plants as food and medicine. These plants constitute great reservoir of a wide variety of compounds which exhibits some medicinal and nutritive properties; thus are used as spices, food or medicinal plants [5;6;7].Many of these indigenous plants contain bioactive compounds that show physiological activities against bacteria and other microorganisms or are precursors for the synthesis of useful drugs [8;9]. The usefulness of these plant materials medicinally, is due to the presence of bioactive constituents such as alkaloids, tannins, flavonoids and phenolics compounds [10]. These chemicals are known to carry out vital medicinal roles in human body.

Alkaloids are known to have a powerful effect on animal physiology. They play some metabolic role and control development in living system [11]. They are also used as starting materials in the manufacture of steroidal drugs and carry out protective function in animals, thus are used as medicine especially steroidal alkaloids [12; 13]. Isolated pure plant alkaloids and their synthetic derivatives are used as basic medicinal agent for their analgesic, antispasmodic and bacteridal effect [14]. Flavonoids are reported to carry out antioxidant protective effects and inhibit the initiation, promotion and progression of tumors [15;16]. Some types of flavonoids, isoflavonones are phytoestrogen which effectively modulate estrogen levels in human [17]. Phenolic compounds in plants are potentially toxic to the growth and development of pathogens [18].Research reports also show that phenolic compounds carry out potent antioxidant activity and wide range of pharmacologic activities which include anti- cancer, antioxidant and platelet aggregation inhibition activity [19;20;21;22]. Saponins are reported to play important roles in medicine, which include being used as expectorant and emulsifying agent [23] and antifungal properties [7]. Tannins inhibit

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pathogenic fungi [24] and at low concentration show antimicrobial, cytotoxic and astringent properties [25;26].

*Lagenaria vulgaris* is an annual herb with either climbing or trailing habit. Vines are 3-4 m in length with stems that are robust and longitudinally furrowed covered with glandular hairs. The tendrils are double branched. The leaves are ovate and about 4- 10cm wide, dentate, sometimes with 3-7 lobes and hairy at the lower epidermis. The petioles are 5-10 cm in length with 2 glands at the junction with the lamina. The flower is monoecious. The male flower is white in colour and up to 10cm in length and 8-10 cm in diameter on a short peduncle. The ovary is inferior. The fruit varies in shape and size. The colour is green mottled with white and 10 - 100 cm in length with hard rind, frequently bottle shaped [27]. *L. vulgaris* is used in herbal medicine in the treatment of poison, stomach acidity, indigestion, ulcer, boils and headache [4;28;29].

*Trichosanthes cucumerina* is a climbing annual herb. Leaves are hairy, dentate, 10- 25 cm in length and 15 cm in diameter. They emit foetid odour when damaged. Flowers are monoecious, axillary and white. Male flowers occur in long racemes with peduncles up to 30 cm in length. The female flowers are solitary. Fruits are cylinderical with waxy surface, slender and tapering 40-120 cm in length and 4-10 cm in diameter [27].*T. cucumerina* is of important medicinal value. Trichosanthin from *T. cucumerina* is reported to have the ability to inhibit the replication of human immuno deficiency virus (HIV) infected lymphocyte and phagocyte cells, indicating potential therapeutic agent for AIDS [30].It can also act as a natural antibiotic, expectorant, laxative, cure constipation and jaundice and has been shown to be excellent for diabetes [31].Furthermore, it is used in the treatment of cold, bronchitis, cough and asthma [32].

*Momordica charantia* is an annual climbing herb vine growing up to 3-4 m in length. Stems are slender, 5-angled and longitudinally furrowed. Tendril is simple or branched. Leaves are lobed and have foetid odour when rubbed. Flowers are monoecious, axillary and solitary. Fruits are pendulous, green and becoming orange or yellow when mature. The size and shape vary, but it is often pear shaped or oblong and tapering. Its length is 10-12cm and 5-8 cm in diameter. Seeds are brown with scarlet aril, flatten and oval 1- 1.5 cm in length [27].*M. charantia* has laxative, emetic and emmenogogue properties. It is also reported to cure arthritis, cold, hypertension, fever, eczema, herpes, influenza, diabetes, intestinal worms and aphrodisiac [3;33;34; 35].

*Luffa cylindrical* is an annual climbing vine with several lobed leaves. The leaves give off a rank odour when crushed and are covered with short stiff hairs. Flowers are monoecious. The male flowers occur in clusters, while the female flowers are solitary. Fruits are smooth and cucumber shaped. The exterior is green and sometimes mottled with longitudinal lines [27]. *L. cylindrical* exhibits emetic and laxative properties. It also relieves asthma and intestinal worms [33;34].

## Materials and methods

### Plant sample

The mature plants and fruits of *Lageneria vulgaris, Trichosanthes cucumeria, Momordica charantia, and Luffa cylindrical* were collected from different locations within the environment of Michael Okpara University of Agriculture, Umudike Umuahia, Abia State, Nigeria. They were identified by the taxonomic unit of the Botany section of the Department of Biological Sciences, Michael Okpara University of Agriculture, Umudike Umuahia, Abia State, Nigeria.

### Preparation of samples for analysis

The plant samples were dried at 65$^{o}$C for 24 hours with Selecta model 150- 900L oven and ground into powder using Thomas Willey milling machine. Powdered samples were stored in clean sample bottles for analysis.

### Quantitative analysis for phytochemicals

### Alkaloid determination

The alkaloid content of the samples was determined through the alkaline precipitation method described by Harborne[36].

2g of each test sample was mixed with acid in ethanolic extractant (10% acetic acid in ethanol) in the ratio of 1:10 w/v. The mixture was allowed to stand in the extractant for 4 hours at room temperature. It was then filtered with Whatman No. 42 filter paper and the filtrate concentrated to about ¼ its original volume by evaporation. The alkaloid was the precipitated by drop wise addition of concentrated ammonium solution in excess before centrifuging for 10 minutes at 5000x. The supernatant was discarded and the precipitate washed with 1% ammonium solution and transferred to a weighed crucible, dried in the oven at 80- 100 ◦ C, cooled in a

desiccator and reweighed. The alkaloid content was calculated with the value obtained.

**Flavonoid determination**

The flavonoid content of the test samples was determined using the acid hydrolysis gravimetric method described by Harborne [36]. .

5 g of the powdered sample were dispensed into a conical flask and 50 ml of water and 2 ml of dilute HCl solution was added to it. The mixture was boiled for 30 minutes and allowed to cool before being filtered through Whatman filter paper (No. 42). 10 ml ethyl acetate was used to extract the flavonoids. A preweighed Whatman (No 42) filter paper was used to filter the extract and the residue dried in the oven at $60^0$ C., cooled and weighed. The flavonoid content was calculated with the value obtained.

**Phenol determination**

The phenol content was determined using the method of the Association of Official Analytical Chemists (A.O.A.C)[37].

0.5g of the test sample was treated with 10 ml of pure methanol to extract the phenol and was filtered. 1 ml of the filtrate was mixed with equal volume of Folin-Ciceacteau reagent and 2 ml of 20% $Na_2CO_3$ solution. The intensity of the colour developed was then measured spectrophotometrically at 560 nm. A standard phenol solution and a reagent blank were prepared and treated as above at the same time with the test samples. The phenol content was calculated with the value obtained.

**Saponin determination**

The saponin content of the test samples was determined by the double solvent extraction gravimetric method of Harborne, [36].

5 g of the powdered sample was mixed with 50 ml of 20% aqueous ethanol solution. The mixture was heated with periodic agitation in water bath for 90 minutes at $55^0$ C. The mixture was filtered and the residue extracted with 50 ml 20% ethanol and both extracts were poured together. The combined extract was reduced to about 40 ml at $90^0$ C and transferred to a separating funnel where 40 ml diethyl ether was added and shaken vigorously. Separation was carried out by partitioning, during which the ether layer was discarded and the aqueous layer reserved. Re extraction by partition was done repeatedly until the aqueous layer became clear in colour. Saponins were extracted with 60 ml normal butanol. The combined extracts were washed with 5% aqueous sodium chloride solution and evaporated to dryness. It was further dried at $60^0$ C in the oven and weighed after cooling in a desiccator. The value obtained was used to calculate the concentration of saponin.

**Tannin determination**

The tannin content was determined using the Folin-Dennis spectrophotometric method described by Pearson [38].

2 g of the test sample was mixed with 50 ml distilled water in a conical flask, shaken in a shaker for 30 minutes. The mixture was filtered and the filtrate was put into 50 ml volumetric flask and diluted with 35 ml distilled water. 5 ml standard tannic acid was further added to the volumetric flask. 1 ml Folin- Dennis reagent was also added into the flask, followed by 2.5 ml saturated sodium carbonate solution. The content of the flask was made up to mark and incubated for 90 minutes. The absorbance of the developed colour was measured at 760 nm wavelength. The value obtained was used to calculate the concentration of tannin.

**Result**

The results of the phytochemical screening of the leaves, pericarps and seeds of *Lagenaria vulgaris*, *Trichosanthes cucumerina*, *Momordica charantia* and *Luffa cylindrical* are summarized in tables 1- 3. Alkaloids, flavonoids, phenols, saponins and tannins are found in all the species and plant parts work on.

Table1: The alkaloids, flavonoids, phenols, saponins and tannin content mg $ml^{-1}$ of the leaves of the wild cucurbits investigated.

| Plant species | Alkaloid | flavonoid | phenol | saponin | tannin |
|---|---|---|---|---|---|
| *L. vulgaris* | 0.030 | 0.110 | 0.400 | 0.070 | 0.982 |
| *T.cucumerina* | 0.030 | 0.110 | 0.300 | 0.050 | 0.635 |
| *M. charantia* | 0.030 | 0.050 | 0.501 | 0.060 | 0.711 |
| *L. cylindrical* | 0.060 | 0.070 | 0.611 | 0.080 | 0.794 |

The alkaloid content of the leaves ranged from 0 03 to 0.060 mg $ml^{-1}$, while that of the pericarp ranged from 0.020 to 0.070 mg $ml^{-1}$ and that of the seeds ranged from 0.030 to 0.070 mg $ml^{-1}$. Generally, the seeds contain more alkaloid than the other parts. In all the species, the tannin content (leaves (0.635- 0.982 mg $ml^{-1}$), pericarp

(0.612- 0.885 mg $ml^{-1}$) seeds (0.484- 0.900 mg $ml^{-1}$)) was more than the other phytochemicals.

Table2: The alkaloids, flavonoids, phenols, saponin and tannin content mg $ml^{-1}$ of the pericarps of the wild cucurbits investigated.

| Plant species | Alkaloid | flavonoid | phenol | saponin | tannin |
|---|---|---|---|---|---|
| *L. vulgaris* | 0.070 | 0.120 | 0.360 | 0.070 | 0.612 |
| *T. cucumerina* | 0.040 | 0.100 | 0.560 | 0.060 | 0.885 |
| *M.charantia* | 0.030 | 0.090 | 0.300 | 0.050 | 0.717 |
| *L.cylindrical* | 0.050 | 0.060 | 0.077 | 0.050 | 0.670 |

Flavonoids and phenols were fairly were fairly distributed in all the plants and parts studied. However, the phenol content of the seeds of *L. cylindrical* was highest when compared with the other species and parts.

Table 3: The alkaloids, flavonoids, phenols, saponins and tannins content mg $ml^{-1}$ of the seeds of the wild cucurbits investigated.

| Plant species | Alkaloid | flavonoid | phenol | saponin | tannin |
|---|---|---|---|---|---|
| *L. vulgaris* | 0.070 | 0.120 | 0.360 | 0.070 | 0.612 |
| *T. cucumerina* | 0.060 | 0.070 | 0.290 | 0.060 | 0.484 |
| *M.charantia* | 0.060 | 0.090 | 0.211 | 0.040 | 0.588 |
| *L. cylindrical* | 0.030 | 0.090 | 0.978 | 0.070 | 0.900 |

The leaves of *L. cylindrical* had the highest saponin content (0.080 mg $ml^{-1}$), while the seeds of *M. charantia* had the least amount of saponin (0.040 mg $ml^{-1}$).

## Discussions

The parts of the investigated plant species were found to contain alkaloids, flavonoids, phenols, saponins and tannins. The presence of these phytochemicals in these plants enhances their pharmaceutical and therapeutic potentials. Alkaloids, flavonoids, phenols, saponins and tannins are reported to carry out antimicrobial activities [39].

The presence of alkaloids in the investigated plants of the wild cucurbits indicates that they have medicinal values. Alkaloids have powerful effect on the physiology of animals. They play some metabolic role and control development in living system [11]. Alkaloids are also used as starting materials in the manufacture of steroidal drugs and carry out protective functions in animals, thus are medicinal especially steroidal alkaloids [12; 13]. Isolated pure plant alkaloids and their synthetic derivatives are used as basic medicinal agent for their analgesic and antisplamodic and bactericidal effects [14; 40].

All the parts of the plant investigated contained flavonoid. Flavonoids are documented to carry out antioxidant protective effects and inhibit the initiation, promotion and progression of tumors [15;16].Iso flavonones some forms of flavonoids are phytoestrogen which effectively modulate estrogen levels in human [17].

The leaves, pericarps and seeds of *L. vulgaris, T. cucumerina, M. charantia* and *L. cylindrical*, had phenols. Phenolic compounds in plants are reported to be potentially toxic to the growth and development of pathogens [18]. Phenolic compounds are indicated by researchers to carry out potent antioxidant activity and wide range of pharmacologic activities which include anti cancer anti oxidant and platelet aggregation inhibition activity [19;20;21;22].Thus confer medicinal value to the plants.

Saponins were obtained in the tissues of the plant species investigated. Saponins are useful in medicine and pharmaceutical industries due to their foaming ability that produces frothy effects in the food industry. They are also used in the manufacture of shampoos, insecticides, various drug preparations and synthesis of steroidal hormones [41].

The leaves, pericarps and seeds of the studied plant species are found to have high tannin content, thus are of high pharmaceutical and therapeutic values. Tannins have been shown to have astringent properties, hastening the healing of wounds and inflamed mucous membranes [40;42;43].

This investigation revealed that the leaves, pericarps and seeds of these wild cucurbits, *L. vulgaris, T. cucumerina, M. charantia* and *L. cylindrical* have high pharmaceutical and therapeutic potential due to the phytochemicals they contain and can be utilized in the treatment of many diseases and also be exploited for use in the pharmaceutical and cosmetic industries.

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