Thaumatococcus daniellii Leaves: A Study of the Plant's Medicinal and Nutritional Properties

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Abstract

The medicinal and nutritional properties of Thaumatococcus daniellii leaves were investigated in this study. A proximate and phytochemical analysis of leaf samples showed the presence of plant compounds that are of great value to human medicinal and nutritional needs. The leaf of T. daniellii when investigated contained (per 100g): 10.50% moisture, 8.90% Ash, 17.21% Lipid, 21.26% Protein, 24.61% Crude Fibre, 17.52% Carbohydrate and 310.01k/cal of energy value. Cyanogenic glycoside, Alkaloid, Flavenoid and Tannin were significantly present in the leaf in the concentration of 0.51mg/100g, 0.40mg/100g, 0.34mg/100g and 0.70mg/100g respectively. The plant leaves contain compounds which when harnessed properly, can be of medicinal and nutritional value in the prevention of diseases like colon cancer, diabetes and protein calorie malnutrition which is the driver of many nutritional pathologies. Overall, when this is done, the public health community benefits as it will make for a healthier society.

INTRODUCTION

Thaumatococcus daniellii (Benth) is a member of a diverse family of plants known as *Marantaceae*. Native to the tropical forest zones of West Africa, the plant is globally famous for its low calorie, nondiabetic natural sweetener called thaumatin found in its aril **(1)**. The perennial monocotyledonous herb propagates itself by rhizomes and forms an undergrowth of trees in its natural habitat**. (2).** It has long, slender stalks that can grow up to two or three meters high, each bearing a single, tough, ovoid-shaped leaf of varying sizes depending on the plants age and habitat **(3).** The flowers most prolific from July until late October, and ripening from January until mid-April are purple pinkish with short spikes and long bracts at the base of the swollen petiole **(4).** The fruit furnishes the protein sweetener which is widely used in beverage, confectionery and pharmaceuticals industries. In addition, the stalks in some cases are used to line utensils in which food is prepared particularly in Southwestern, Nigeria **(5).** Furthermore, *Thaumatococcus daniellii* has contributed to the rural economy of some West African natives, who have been using several parts of the plant for centuries in wrapping food materials, making thatching roots, weaving baskets, mats and as taste modifier **(5).**

MATERIALS AND METHODS

SAMPLE COLLECTION AND PREPARATION

The leaves of *T. daniellii* used in this study were collected from the residence of Elder Nkemakolam Nnanna of Umueze in Umuemem Akabor Oguta Local Government Area of Imo State and were authenticated by the Department of Plant Science and Biotechnology, Imo State University Owerri. The sample was sun-dried and grinded into flour. The flour obtained was put into a sterile container, covered and was transferred to the Food Science Technology Laboratory of Imo State University for analysis.

QUALITATIVE TESTS FOR PHYTOCHEMICALS

PREPARATION OF THE EXTRACTS (AQUEOUS EXTRACT)

20g of the sample was soaked in 200ml of distilled water in a beaker and boiled for 30mins. The solution obtained was filtered using filter paper and the filtrate was used for the phytochemical screening.

SAPONIN (FROTHING TEST)

5.0ml of the filtrate was diluted with 20ml of distilled water and shaken vigourously and observed on standing for stable froth.

ALKALOIDS (WAGNER'S TEST)

1.0ml of the extract of the sample was shaken with 5.0ml of 2% HCL on a steam bath and filtered. To 1.0ml of the filtrate, Wagner's Reagent (iodine in potassium iodide) was added and a reddish brown precipitate was obtained.

TANIN

5.0ml of the extract was added to 2.0ml of 1% HCL. Deposition of a red precipitate indicated a positive result.

FLAVENOID (SODIUM HYDROXIDE TEST)

To 2.0ml of the extract 2.0ml of dilute NaOH was added. Precipitation was observed which indicated the presence of Flavenoid.

CYANOGENIC GLYCOSIDES

1.0g of the powdered plant material was covered with sufficient water in a stoppered flask into which sodium picrate paper was suspended by trapping it with a cork. The flask was placed in a water bath for 1 hour. A change from the yellow colour of the paper to brick red colour indicated a positive result for cyanogenic glycosides.

PHENOLS (FERRIC CHLORIDE TEST)

To 2.0ml of the extract few drops of dilute ferric chloride solution was added. The formation of green colouration was observed which indicated the presence of phenol.

RESULTS OF PHYTOCHEMICAL SCREENING

The results of the phytochemical screening of *T. daniellii* are presented in the table below:

TABLE 1: RESULT OF THE QUALITATIVE DETERMINATION OF PHYTOCHEMICALS

PHYTOCHEMICALS	PETROLEUM ETHER EXTRACT	CHLOROFORM EXTRACT	METANOL EXTRACT
Cyanogenic glycoside	-	-	+
Alkaloids	+	-	-
Flavenoids	-	+	-
Saponins	-	-	-
Tannins	+	+	-
Phenol	-	-	-

KEY

\+ = Present

\- = Absent

The results of the phytochemical screening presented in the table above shows that cyanogenic glycoside, alkaloids, flavonoid and tannin were present in the analyzed sample while there was no trace of saponin and phenols.

PROXIMATE ANALYSIS

The proximate analysis of *T. daniellii* leaf was done using the standard procedures of Association of Official Analytical Chemists (AOAC) **(6)** The data for the proximate composition was recorded in percentage. The moisture content of the sample was determined by weighing the sample into a crucible and drying at a temperature of 105^0C using an oven. Ashing at about 550^0C was done to determine the ash content; this was carried out for a period of 3 hours. The protein content was estimated using kjeldah procedure; the nitrogen value multiplied with a conversion factor of 6.25. Following a successful digestion of the sample, the crude fibre content was estimated, crude fat was done by Soxhlet extraction procedure. The difference of the sum of all the proximate compositions from 100% then gave the measure of the carbohydrate content.

RESULTS OF PROXIMATE COMPOSITION

The result of proximate composition of the sample analyzed is presented in table below:

TABLE 2: Results of the proximate composition of *T. daniellii* leaf in percentage (%):

PARAMETER	COMPOSITION
Moisture (%)	10.50 ± 0.03
Ash (%)	8.90 ± 0.05
Lipid (%)	17.21 ± 0.07
Protein (%)	21.26 ± 0.20
Fibre (%)	24.61 ± 0.01
Carbohydrate (%)	17.52 ± 0.06

MEDICINAL AND NUTRITIONAL PROPERTIES OF THAUMATOCOCCUS DANIELLI

Proximate and phytochemical analysis of *T. daniellii* leaves shows it contains compounds that are of medicinal and nutritional benefit to humans. Alkaloids have been reported to exhibit microbiocidal effect as well as anti-diarrheal action, antihypertensive, antiinflammatory and anti-fibrogenic actions **(7).** Studies have also shown that some alkaloids exhibits useful activity against HIV/AIDS as well as associated intestinal infections **(8).** This is to say that *Thaumatococcus daniellii* can be recommended to patients with intestinal problems like diarrhea. Tannins can however show toxicity towards filamentous fungi, yeast and bacterial; hence their presence in plants therefore offers them the ability to be useful medicine; this is because, tannin as a bioactive component has the ability to hasten the process of wound healing. Their usage as antimicrobial, anti-inflammatory and antioxidants has all been attributed to their astringency property **(9).**

In vitro studies have shown that flavonoids have anti-allergic, anti-inflammatory **(10),** anti-microbial **(11),** anti-cancer **(12)** and hypolipidemic effects **(13).** Flavenoids have also been reported to be potent anti-oxidant and free radical scavengers capable of protecting cell membranes from damage **(14).** Thus the leaves of *T. daniellii* have proven medicinal properties.

Food rich in dietary fibre contributes to the prevention of various diseases such as constipation, colon cancer, excess colestorol, diabetes and diverticulitis **(15).** The Ash is an index of minerals present in a sample. The appreciable amount of Ash indicates that *T. daniellii* leaves can be used as a source of mineral **(16).** Mineral elements are considered to be essential substances for the well-functioning of an organism. They play vital role in regulating the different biological processes of an organism such as: activating the intracellular and extracellular enzymes, regulating the lipid compartment pH which permits the achievement of metabolic reactions and controlling the osmotic equilibrium between cells and their environment.

CONCLUSION

There is a plethora of published works that show *T. daniellii* contain compounds that are of essential medicinal and nutritional properties. However, though there are traditional practices of people taking leaf extracts of the plant for treatment of various diseases, there is need for more work that will help in extraction of these compounds and apply them to modern pharmaceutical use. The drugs manufactured with the plant compounds as components, can be used in the treatment of the relevant diseases as mentioned in this article. This will be of great public health benefit as it will make the society healthier.

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