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Proximate composition and phytochemical screening of Teak (*Tectona grandis*) leaves as phytogenic feed additive in poultry diets

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Abstract

Teak is more considered as a major constituent in many of the traditional medicines. The proximate and phytochemical analysis of Tectona grandis leaf meal were carried out by adding it as an additives or supplements in the feed fed to broiler chickens. The fresh leaves were sliced and air-dried for 10 days and milled into fine particles. The prepared sample was kept in air tight polythene bags to prevent exposure to air, the leaves were subjected to proximate and phytochemical analysis. Data showed that the leaves had low moisture 4.57±0.40%, high carbohydrates 40.30±1.07%, protein, fibre, fat and ash of 13.28±0.28%, 28.29±0.52%, 2.17±0.28%, 11.4±0.40%, respectively. The leaf samples of Tectona grandis were screened quantitatively. Results revealed the presence of flavonoid, saponin, phenol, alkaloids and tannins. Saponin, phenol and tannin were present in large amount with 55.55±20.83mg/g, 44.87±4.41mg/g and 10.50±0.56mg/g, respectively which are responsible for its antioxidant and antimicrobial. It is completely clear from the proximate analysis that Tectona grandis leaf meal can be used as alternative medicine and animal growth promoters.

Keywords: *Tectona grandis, proximate, phytochemical, phytogenic feed additive*

Description of Problem

Over the years, plant extracts and plant derived medicines have made an immense contribution to the overall health and wellbeing of man (1). In 1978, World Health Organisation laid emphasise on the importance of scientific research into herbal medicine. Herbs are valued for their virtues as medicine. In animal production, the use of herbs has increased the interest of researcher as a potential substitute for antibiotics. Alternatives available to replace antibiotics are called phytogenic feed additives which include probiotics, prebiotics and essential oils. Phytogenic feed additives are originated from plants that have properties of antimicrobial.

Tectona grandis (Teak) is a tropical tree species distributed naturally in countries like india, Thailand, Nigeria and other tropical countries (2). The use of these plants in alternative medicine is due to the presence of bioactive constituents such as phenols, flavonoids, tannins and alkaloids present either in the seeds, leaves, stems or roots (3). *Tectona grandis* is a large, deciduous tree reaching over 30 meter in height in favourable conditions (4). It is one of the most famous timber in the world and is renowned for its dimensional stability, extreme durability and hard which has resists decay even when unprotected by plants and preservatives (5). The whole plant has been reported to be medicinally important and many reports have been claimed to cure many diseases (6). The different extracts from various parts of teak shows expectorant, anti-inflammatory, antihelmintic properties (6). Traditionally, Tectona grandis is used against bronchitis, biliousness, hyperacidity, diabetes, leprosy and helmintiasis (7).

Phytochemicals are used as templates for lead optimization programs which are intended to make effective drugs safe (8). The experiment was carried out to determine the proximate composition and phytochemicals analysis of teak (*Tectona grandis*) leaf.

Materials and methods

Experimental location

The study was conducted in the poultry unit of Teaching and Research Farm, Department of Agricultural Technology, Federal Polytechnic, Ado-Ekiti, Ekiti State, Nigeria. The state is located in south Western part of the country. Ekiti state covers a land area of 6353km square. It enjoys tropical climate with two distinct seasons which are rainy season (April to October) and dry season (November to March). The mean ambient temperature ranges from 25-28^{0}C with high humidity.

Source and processing of fresh *Tectona grandis* leaves

Fresh *Tectona grandis* leaves were plucked from the premises of Federal Polytechnic, Ado-Ekiti. The fresh leaves were sliced and air dried for 10days until they became crispy. The leaves were turned regularly to avoid uneven drying and decay to ensure that the greenish colour of the leaves was maintained. Thereafter, dried crispy leaves were milled through a 2mm sieve and stored in airtight containers to avoid the absorption of moisture till they were used for laboratory analysis.

Data collection

Proximate analysis

The proximate composition of the leafmeal were determined in triplicates according to the standard procedures of (9). The analysis carried out includes moisture content, fat, ash content, crude fibre, ether extract, crude protein and carbohydrates.

Quantitative determination of phyto-chemical constituents of *Tectona grandis* leaf meal.

Determination of tannin

Analytical method for quantitative determination of tannin was according to (10) and (11). By dissolving 50g of sodium tungstate (Na_2WO_4) in 37cm^3 of distilled water, Follin-Denis reagent was made. To the reagent prepared above, 10g of phospomolybdic acid ($H_3PMo_{12}O_{40}$) and 25cm^3 of Orthophosphoric acid (H_3PO_4) were added. Two-hour reflux of the mixture was carried cooled, and diluted to 500cm^3 with distilled water. One gram of Teak leaf meal in a conical flask was added to 100cm^3 of distilled water. This was boiled gently for 1 hour on an electric hot plate and filtered using number 42 (125mm) Whatman filter paper in a 100cm^3 volumetric flask. Addition of 5.0cm^3 Folin-Denis reagent and 10cm3 of saturated Na_2CO_3 solution into 50cm3 of distilled water and 10cm^3 of diluted extract (aliquot volume) was carried out after being pipetted into 100cm3 conical flask for colour development. The solution was allowed to stand for 30 minutes in a water bath of temperature 25ºC after thorough agitation. With the aid of spectrum lab 23A spectrophotometer optical density was measured at 700nm and compared on a standard tannic acid curve. Dissolution of 0.20g of tannic acid in distilled water and dilution to 200cm^{3}mark (1mg/cm3) were used to obtain tannic standard curve. Varying concentration (0.2-1.0mg/cm^3) of the standard tannic acid solution were pipetted into five different test tube which Folin-Denis reagent (5cm^3) and saturated Na_2CO_3 (10cm^3) solution were added and made up to the 100cm^3 mark with distilled water. The solution was left to stand for 30 minutes in water bath at 25 ºC. Optical

density was ascertained in 700nm with the aid of a spectrum Lab 23A spectro-photometer. Optical density (absorbance) versus tannic acid concentration was plotted.

Determination of alkaloids

Quantitative determination of alkaloid was according to the methodology by (12). Exactly 200cm^3 of 10% acetic acid in ethanol was added to each *Tectona grandis leaf meal* in a 250 cm3 beaker and allowed to stand for 4 hours. The extract was concentrated on a water bath to one-quarter of the original volume followed by addition of 15 drops of concentrated ammonium hydroxide drop wise to the extract until the presentation was complete immediately after filtration. After 3 hours of mixture sedimentation, the supernatant was discarded and the precipitate was washed with 20cm3 of 0.1 M of ammonium hydroxide and then filtered using Gem filtered paper (12.5cm). Using electronic weighing balance Model B-218, the residue was dried in an oven and the percentage of alkaloid is expressed mathematically as

$$\% \text{ Alkaloid} = \frac{\text{Weight of alkaloid}}{\text{Weight of sample}} \times 100$$

Determination of flavonoid

Flavonoid determination was by the method reported by (11) and Boham and Kocipai (13). Exactly 50cm3 of 80% aqueous methanol was added to 2.50g of sample in a 250cm3 beaker, covered and allowed to stand for 24 hours at room temperature. After discarding the supernatant the residue was re-extracted (three times) with the same volume of ethanol. Whatman filter paper number 42 (125mm) was used to filter whole solution of *Tectona grandis* leaf meal. Each *Tectona grandis* leaf meal filtrate was transferred into a cubicle and evaporated to dryness over a water bath. The content in the cubicle was cooled in the desiccator and weighed until constant weight was obtained. The percentage of flavonoid was calculated as

$$\% \text{ Flavonoid} = \frac{\text{Weight of flavonoid}}{\text{Weight of sample}} \times 100$$

Determination of saponin

Flavonoid determination was by the method reported by (11). Exactly 100cm3 of 20% aqueous ethanol was added to 5 grams of *Tectona grandis* leaf meal in a 250cm3 conical flask. The mixture was heated over a hot water bath for 4 hours with continuos stiring temperature of 55 ºC. The residue of the mixture was re-extracted with another 100cm3 of 20% aqueous ethanol after filtration and heated for 4 hours at a constant temperature of 55 ºC with constant stirring. The combine extract was evaporated to 40cm^3 over water bath at 90^{0}C. 20cm^3 of diethyl ether was added to the concentrate in a 250 m^3 separator funnel and vigorously agitated from which the aqueous layer was recovered while the ether layer was discarded. This purification process was repeated twice. 60cm^3 of n-butanol was added and extracted twice with 10c m^3 of 5% sodium chloride. After discarding the sodium chloride layer, the remaining solution was heated in water bath for 30minutes, after which the solution was transferred into a crucible and was dried in an oven to a constant weight. The saponin content was calculated as a percentage.

$$\% \text{ Saponin} = \frac{\text{Weight of saponin}}{\text{Weight of sample}} \times 100$$

Determination of phenol

Defatting of *Tectona grandis* leaf mean was carried out for 2hours in 100cm^3 of ether using a sohlext apparatus. The defatted sample was boiled for 15minutes with 50cm^3 of ether for the extraction of phenolic components. Exactly 10c m^3 of distilled water, 2c m^3 of 0.1N ammonium hydroxide

solution and 5c m^3 of concentrated amyl alcohol was also added to 5c m^3 of the extract and left to react for 30minutes for colour development. The optical density was measured at 505nm. 0.20g of tannic acid was dissolving in distilled water and diluted to 200ml mark in preparation for phenol standard curve. Varying concentration (0.2-1.0mg/cm^3) of the standard tannic acid solution was pipetted into 5 different test tubes to which 2c m^3 of NH_3OH, 5c $m^3$of amyl alcohol and 10c m^3 of water were added. The solution was made up to 100cm^3 and left to react for 30minutes for colour development. The optical density was determined at 505nm (14).

Results and Discussion

The proximate components of *Tectona grandis* leafmeal as shown in Table 1 indicated 4.57±0.40, 11.4±0.40, 2.17±0.28, 28.29±0.52, 13.28±0.28 and 40.30±1.07 of moisture content, ash, fat, crude fibre, crude protein and carbohydrate, respectively.

The result of phytochemical screening of *Tectona grandis* are shown in Table 2. It showed that *Tectona grandis* leafmeal contained tannin, alkaloids, flavoids, saponin and phenol. The tannin, alkaloids, flavoids contents of *Tectona grandis* are 10.50±0.56mg/g, 0.08±0.01, 3.15±0.61 respectively. Saponin and phenol contents of *Tectona grandis* are 55.55±20.83mg/g, 44.87±4.41mg/g, respectively.

Table 1: Proximate composition of *Tectona grandis* leaf meal

Component	Quantity (%)
Moisture	4.57±0.40
Ash	11.4±0.40
Fat	2.17±0.28
Fibre	28.29±0.52
Protein	13.28±0.28
Carbohydrate	40.30±1.07

Table 2: Phytochemical analysis of *Tectona grandis* leaf meal

Parameters	Quantity (mg/g)
Tannin	10.50±0.56
Flavonoid	3.15±0.61
Phenol	44.87±4.41
Saponin	55.55±20.83
Alkaloids	0.08±0.01

The low moisture content of the sample implied that the leafmeal can be preserved for a long period after drying at room temperature. This will perhaps increase the relative concentration of the nutrients and improve the shelf life of the leafmeal (15). The fiber content is however high (28.29±0.52%) when compared with 10.97% reported by (16). High fibre content in food has been reported to cause intestinal irritation and lower nutrient bioavailability (17). The value of fat in the leafmeal was very low (2.17±0.28) which shows that it is low in cholesterol level. The ash content (11.4±0.40%) of *Tectona grandis* leafmeal was lower compared to 19.17% reported by (18). This is reflective of the fact that teak leaf is a potential source of high dietary minerals and may likely contain useful nutritionally important minerals elements (19).The protein content is however high with (13.28±0.28%) when compared to the result reported by (16) with protein content of 10-13% crude protein which implies that teak leaves helps in growth promoters and building up worn-out tissue in animals. The leafmeal of *Tectona grandis* is rich and a good source of carbohydrate content (40.30±1.07) compared to the result reported by (20) which shown that it has a potential benefit as carbohydrates is essential for energy synthesis in animal (21) and it also put leaf meal in advantage to be equally use as animal feeds.

The phytochemical analysis of *Tectona grandis* leafmeal in Table 2 revealed the

presence of tannis, alkaloids, flavoids, saponnin and phenol.

The tannin content is however low with 10.50±0.56mg/g which is responsible for the bitter taste of leaf and it protects teak from predators like termites and also as pesticides. Alkaloids extract invoke a bitter taste on leaves males the leaves and tree poisonous to predating organisms. However, the alkaloids content is low with 0.08±0.01mg/g. The flavonoids from *Tectona grandis* leaf is low (3.15±0.61mg/g). Flavonoids are present in plants as antioxidant as well as antimicrobial agents against a wide range of microorganisms by inhibiting their membrane bound enzymes. Thus flavonoid promotes growth, repair worn-out tissue, serve as source of energy in the absence of carbohydrates and fats, build hormones that assist in the regulation of body processes and build antibodies that fight infections and diseases (22). The presence of alkaloids and flavonoids in *Tectona grandis* indicates its antimicrobial (23) and antioxidant (24). Saponnin are steroid or interpenoid glycosides characterized by bitter taste, foaming properties and their haemolytic effects on red blood cells were largely found in the sample. Saponnin are often bitter to taste and therefore reduce plant palatability. Saponnin is high (55.55± 20.83mg/g) in which the consumption of saponin has been encouraged because of their hypocholesterolemic activity. Phenol imparts taste, odour, colour and oxidative stability in plants based food (25). The phenol content helps to increase the feed efficiency and consumption rate of birds.

Conclusion and Application

1. It is completely clear from the proximate analysis that *Tectona grandis* leafmeal can be used as alternative medicine and animal growth promoters.
2. The high level of antimicrobial and antioxidants properties could promote growth by enhancing nutrient utilization, repair of worn-out tissues and eliminate diseases are noted.
3. The use of *Tectona grandis* leafmeal in feeding of monogastric animals to evaluate their medicinal values is recommended.

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