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Comparative Estimation of Alkaloids, Flavonoids and Saponin in Selected Medicinal Plants in Taraba State

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Abstract
Estimation of alkaloids, flavonoids and saponin of four plants were carried out using chemical methods. The results showed that all the plant leaf extracts contained alkaloids, flavonoids and saponin at various quantitie. In F. septica, flavonoids has the highest quantity of 508mg/g followed by saponin with 403.2mg/g and lastly is alkaloids with 298.8mg/g. in P.biglobosa. The highest quantity of saponin shows 676mg/g followed by flavonoids with 402.4mg/g and lastly alkaloids having 226mg/g. The result from P. clappertoniana in which there is highest quantity of saponin, 374.2mg/g followed by alkaloids, 169mg/g and least is flavonoids,100mg/g. The result from T. indica in which there is highest quantity of saponin given as 824.2mg/g followed by flavonoids given as 677.2mg/g and least of alkaloids given 172.3mg/g. Overall, saponin had the highest occurrence in the three of the four plants under study. Flavonoids is next to saponin in the three plants and the least occurrence is alkaloids having the lowest occurrence in three of the plants. This quantitative test showed that the leaves of Ficusseptica, Parkiabiglobosa, Parkiaclappertoniana and Tamarindusindica are good sources of useful drugs to bring for improving general health conditions.

INTRODUCTION
Plants generally have active components in them which serve as bioactive and are known as phytochemicals. Phytochemicals also refer to plant chemicals that protect plant cells from hazards like ultraviolet exposure, pollution, drought e.t.c (Hasler *et al.*, 1999). Since the phytochemicals cure diseases without causing any harm to human beings these can also be considered as "man- friendly medicines". Nigerian rural population depends on traditional medicine for their health care need (Apulu *et al.*,1994). Many of the plants materials used in traditional medicine are readily available to rural dwellers and these have made traditional medicine relatively cheaper than modern medicines. Medicinal properties of plants are normally dependent on the presence of certain phytochemicals, such as tannins, flavonoids, alkaloids and saponin which are bioactive base responsible for the medicinal property (Apulu *et al*., 1994). Many of these indigenous plants are used as spices and food plants. They are also

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sometimes added to food meant for pregnant and nursing mothers for medical purposes (Okwu, 2004). Many of these plants possess bioactive compounds that exhibit physiological activity against microorganisms (Okwu*et al*., 2003). Medicinal plants contain natural active ingredients used to cure diseases or relieve pain (Ojelere*et al*., 2014). These plants are used in the treatment of many diseases such as rheumatism, diarrhoea, dysentery, cough, asthma, malaria, cold and others (Burkill *et al*., 1998). Many plant materials are useful herbs, from which important drugs could be prepared or agents which may serve as starting materials for the partial synthesis of some useful drugs. The use of plant extracts and phytochemicals, both with known antimicrobial properties, can be of great significance in therapeutic treatments. In the last few years, a number of studies have been conducted in different countries to prove such efficiency. Many plants have been used because of their antimicrobial traits, which are chiefly synthesized during secondary metabolism of the plant (Prusti, 2008). Discovery of new antimicrobial compounds with diverse chemical structures and novel mechanisms of action becomes an urgent attention. The development of resistant strains of bacteria has increased the need for new antibiotics (Eloff, 1998). Higher plants, which are able to produce photosynthesis, produce hundreds to thousands of diverse chemical compounds with different biological activities (Hamburger *et al.,* 1991). These antimicrobial compounds produced by plants are active against plant and human pathogenic microorganisms (Sarac *et al*., 2007).

Flavonoids are known to possess antioxidant activity while tannins have anti-diarrhoea activities. Therefore, there is a need to know the total amount of alkaloids, tannins, saponin, proteins, flavonoids and carbohydrates in the plant which correspond to its medicinal activity. Many plant materials are useful herbs, from which important drugs could be prepared or agents which may serve as starting materials for the partial synthesis of some useful drugs. The usefulness of these plant materials medicinally is due to the presence of bioactive constituents such as alkaloids, tannins, flavonoids and phenolic compounds. *Ficusseptica, Parkiabiglobosa*, *Parkiaclappertoniana*and *Tamarindusindica* are abundant in Nigeria. Knowledge of the chemical constituents of plants is desirable because such information will be of value for the synthesis of new bioactive compounds for treating the specific disease. Nowadays these phytochemicals become more popular due to their countless medicinal uses.

The plant kingdom represents a treasure of structurally diverse bioactive molecules. Most of the best plant medicines are the sum of their constituents. The beneficial physiological and therapeutic effects of plant materials typically result from the combinations of these secondary products present in *Ficusseptica, Parkiabiglobosa*, *Parkiaclappertoniana* and *Tamarindusindica*. The information on the constituents of the plant clarifies the uses of the plants but only small percentage have been investigated for their phytochemicals constituent. As more phyto constituents are being identified and tested, traditional uses of the plants are being verified (Hamburger *et al.,* 1991). A review of these plants various phytochemical constituents are as shown in the table 1 that follows:

Table 1: Some plants various phytochemical constituents

Species	Family	Detected Phytochemicals	Reference
F. septic	Moraceae	Alkaloids, steroids, saponin, tannins, flavonoids	Parkas *et al*.,(1982)
P. biglobosa	Fabaceae	Alkaloids, tannins, steroids, saponin, cardiac glycosides	Ajaiyeoba*et al.,* (1998)
P. clappertoniana	Fabaceae	Alkaloids, tannins, steroids, saponin, cardiac glycosides	Ajaiyeoba*et al.* (1998)
T. indica	Fabaceae	Alkaloids, flavonoids, saponin& tannins	Ushie *et al*. (2016)

Challenges of traditional medicines such as proper dosage during administration, familiarity of herbs to the naked eye resulting in their being mistaken for one another, The herbs are interchanged in their role when they are being administered due to lack of idea about the constituent phytochemicals and ailment they are active upon. This research provides information about the quantitative composition and comparison of the phytochemicals in *Ficusseptica, Parkiabiglobosa*, *Parkiaclappertoniana* and *Tamarindusindica.* To the best of our knowledge no work on the quantification of phytochemicals has been carried out on the plants in this part of the world. Aim of this research is to quantify and compare the phytochemicals present in *Ficusseptica, Parkiabiglobosa*, *Parkiaclappertoniana*and *Tamarindusindica*.

MATERIALS AND METHODS

Sample Collection

The leaves of *F. septica*, *P. biglobosa,* and *P. clappertoniana* were collected from Wukari local government area while that of *T. indica* was collected in Zing local government area all in Taraba State, Nigeria. These plant leaves were collected freshly and the identification was done by the Biological Sciences Department of Federal University Wukari. The leaves were air dried for 3 weeks. After drying, the plant materials were well pounded into powders.

Methodology

The phytochemicals in the sample extract were estimated using standard procedures as described by Harborne (1973), Obdoni and Ochuko (2001), Krishnaiah *et al*, (2009)**,** Sathya *et al*, (2013) and Ushie *et al*., 2018

Estimation of Alkaloids

Determination of alkaloids was done by using Harbone (1973) method. To 5g of the sample, 200mLof 10% acetic acid in methanol was added and covered then allowed to stand for 4 hours. It was filtered and the filtrate was concentrated on a water bath to one-quarter of the original volume. Concentrated NH_4OH was added drop wise to the filtrate until precipitation was complete. The whole solution was allowed to settle and the precipitate was collected and washed with dilute NH_4OH and then filtered. The residue is the alkaloid, which was dried and weighed.

Estimation of Flavonoids

Ten (10g) of plant sample was repeatedly extracted with 100mL of 80% aqueous methanol at room temperature. The whole solution was filtered using a Whatman No. 42 filter paper into a pre weighed 250mL beaker. The filtrate was transferred into a water bath and allowed to evaporate to dryness and weighed (Krishnaiah*et al*, 2009).

Estimation of Total Saponin

The method used was that of Obdoni and Ochuko (2001). To 20g of the ground sample, 100mL of 20% aqueous ethanol was added. The samples were heated over a hot water bath for 4hours with continuous stirring at about 55°C. The mixture was filtered and the residue re- extracted with another 200mL 20% ethanol. The combined extracts were reduced to 40mL over water bath at about 90°C. The concentrate was transferred into a 250mL separation funnel and 20mLof diethyl ether was added and shaken vigorously. The aqueous layer was recovered while the ether layer was discarded. The purification process was repeated. Sixty (60) mL of n-butanol was added. The combined n- butanol extract were washed twice with 10mL of 5% aqueous NaCl. The remaining solution was heated in a water bath for evaporation and were further dried in the oven to a constant weight and the saponin content was calculated.

RESULTS AND DISCUSSION

Results of Estimation Analysis of Alkaloids

Table 2. The result of the phytochemicals distribution of Alkaloids in the Selected plants.

	F. septic	*P.biglobosa*	*P.clappertoniana*	*T. indica*
No. of samples, n	5	5	5	5
Mean (mg/g)	298	226	169	172.3
Standard deviation (mg/g)	59.6	45.2	33.8	34.5

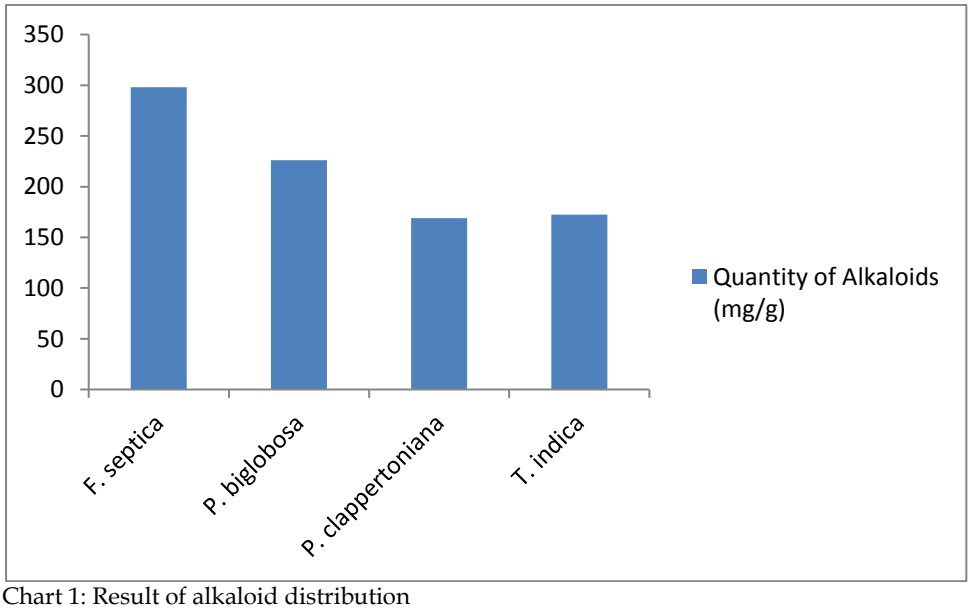


Chart 1: Result of alkaloid distribution

Results of Estimation Distribution of Flavonoids

Table 3: The result of the quantitative distribution of Flavonoids in the selected plants

	F. septica	*P.biglobosa*	*P.clappertoniana*	*T. indica*
No. of samples, n	5	5	5	5
Mean (mg/g)	508	402.4	100	677.2
Standard deviation (mg/g)	101.6	80.5	20	135.4

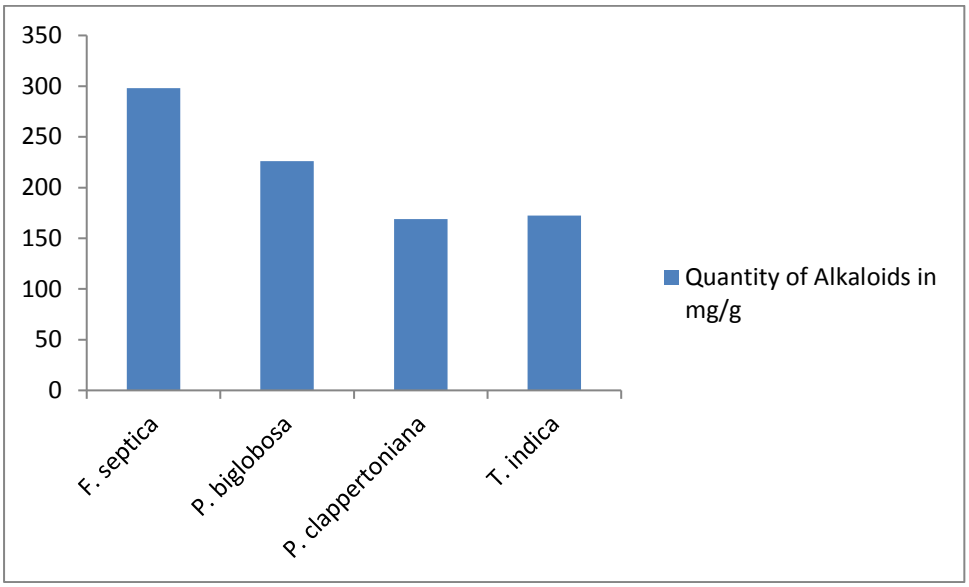


Chart 2: Result of flavonoids distribution

Result of Estimation Distribution of Saponin

Table 4. The results of the quantitative distribution of Saponin in the Selected plants

Particulars	*F. septica*	*P.biglobosa*	*P.clappertoniana*	*T. indica*
No. of samples, n	5	5	5	5
Mean (mg/g)	403.2	676	374.2	824.2
Standard deviation (mg/g)	80.64	135.2	74.84	164.84

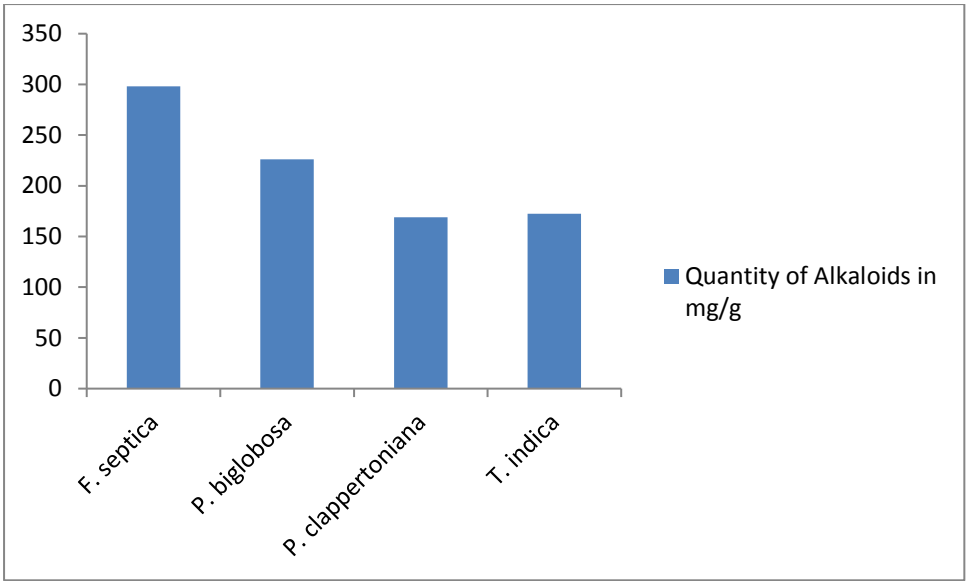
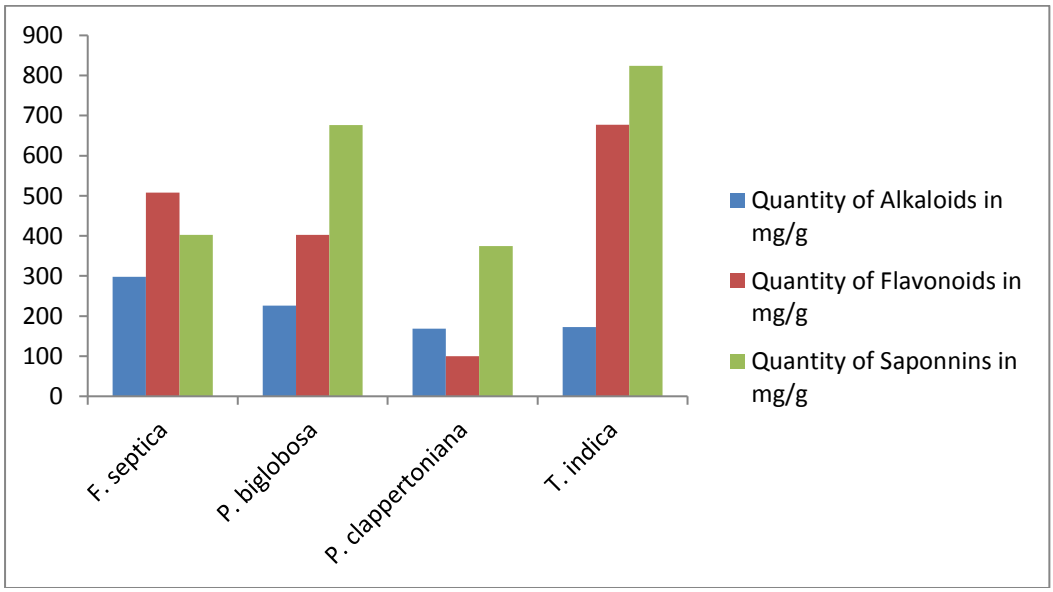


Chart 3: Result of Saponins distribution

Estimate danalysis of *F. septica*, *P. biglobosa*, *P. clappertoniana*, and *T. indica*

Table 5: Results of quantitative analysis of *F. septica*, *P. biglobosa*, *P. clappertoniana*, and *T. indica*

Phytochemicals	**Plants**			
	F.septica	***P.biglobosa***	***P. clappertoniana***	***T.indica***
Alkaloids	298	226	169	172.3
Flavonoids	508	402.4	100	677.2
Saponin	403.2	676	374.2	824.2



Chat 4: Histogram of the phytochemical results of Alkaloids, Flavonoids and Saponin

DISCUSSION

Phytochemicals quantification was carried out on the leaves of *F. septica, P. biglobosa, P.clappertoniana* and *T. indica*. In table 1, it can be seen that in *F. septica*, flavonoids has the highest quantity of 508mg/g followed by saponins with 403.2mg/g and lastly is alkaloids with 298.8mg/g. Table 2 shows the results in *P. biglobosa.* There is highest quantity of saponin shown as 676mg/g followed by flavonoids with 402.4mg/g and lastly alkaloids having 226mg/g. Table 3 is the result from *P. clappertoniana* in which there is highest quantity of saponin, 374.2mg/g followed by alkaloids, 169mg/g and least is flavonoids,100mg/g. Table 4 is the result from *T. indica*in which there is highest quantity of saponins given as 824.2mg/g followed by flavonoids given as 677.2mg/g and least of alkaloids given 172.3mg/g. From the result of the analysis, it can be seen that saponin has the highest occurrence in the three of the four plants under study. Flavonoids follow saponin in also three of the plants and the least occurrence is alkaloids having the lowest occurrence in three of the plants. The results of this research work have shown that the leaves of the plants; *F. septica, P.biglobosa, P.clappertoniana* and *T. indica* possess a wide range of phytochemicals including alkaloids, flavonoids and saponin.

The presence of flavonoids shows that application of leaves of *F. septic, P.biglobosa, P.clappertoniana*and *T. indica*can be used to achieve antioxidant effect. Flavonoids have received considerable attention because of their beneficial effects as antioxidants in the prevention of human diseases such as cancer and cardiovascular diseases and some pathological disorders of gastric and duodenal ulcers, allergies, vascular fragility, and viral and bacterial infections (Jenkins *et al*., 2002). According to Aherne *et al*., (2002) flavonoids show ant mutagenic activities. They may reduce the risk of death from coronary heart diseases (Knekt*et al*., 1996). Flavonoids are potent water soluble super antioxidants and free radical scavengers which prevent oxidative cell damage, have strong anticancer activity and inhibit tumor growth (Ushie *et al*., 2016). The beneficial effects of these leaves have been attributed to flavonoids rather than to known nutrients and vitamins (Felicien, 2008)

Since Saponin occur in these leaves, they could be utilized to bring about low rate of cholesterol and reduce the risk of heart diseases. Saponin cause complexation with cholesterol to form pores in cell membrane bilayers example in red blood cell membranes, where complexation leads to red cell lysis (hemolysis) on intravenous injection (Ushie *et al*., 2016) there is tremendous, commercially driven promotion of saponin as dietary supplements and nutriceuticals (Francis *et al*., 2002). Saponin bind with bile salt and cholesterol in the intestinal tract. Bile salts form small micelles with cholesterol facilitating its absorption. Saponin cause a reduction of blood cholesterol by preventing its reabsorption. Studies have shown that saponin have antitumor and anti- mutagenic activities. They can lower the risk of human cancers. By preventing cancer cells from growing (Roa 1995) and colleagues found out that saponin may help to prevent colon cancer and that saponin are anti- carcinogens. Eating more saponin will boost the immune system as well as help fight fungal infections (Evans *et al*., 2002).

The presence of alkaloids in the leaves of *F. septica, P.biglobosa, P.clappertoniana* and *T. indica* indicates that consumption of these plants produces antiarrhythmic and anticholinergic effect. Alkaloids play an important role in the defense systems against also havepharmacological, veterinary and medical importance (Patel *et al*., 2012). Alkaloids belonging to beta- carboline group possess antimicrobial, anti- HIV and anti-parasitic activities (Bouayad *et al*., 2011). Alkaloids also serve as stimulants, adenosine receptor antagonist, cough medicine, analgesic remedy for gout, anti-protozoan agent (Ushie *et al*., 2018). They could further be used as vasodilator, antihypertensive, antipyretics, anti-malarial and as muscle relaxant. Structurally

modified forms of alkaloid can be produced in form of synthetic and semi synthetic drugs which are designed to enhance or change the primary effect of the drug and reduce unnecessary side effects (Saxton, 1971).

CONCLUSION

From the result of the analysis, it can be seen that saponin has the highest occurrence in the three of the four plants under study. Flavonoid is next to saponin in quantity in three of the plants and the least occurrence is alkaloids having the lowest occurrence in three of the plants. The results of this research work have shown that the leaves of the plants; *F. septica, P.biglobosa, P.clappertoniana* and *T. indica* possess a wide range of phytochemicals including alkaloids, flavonoids and saponin. The result seems to justify the use of these plants as claimed by the traditional healers.

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