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Qualitative and Quantitative Phytochemical Analyses of *Sclerocarya birrea and Sterculia setigera* in Kem and Yola, Adamawa State, Nigeria

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Abstract The stem, roots and leaves of the plants *Sclerocarya birrea* and *Steculia setigera* collected from Kem and Yola, Adamawa State, Nigeria, were analyzed for the presence and amounts of different phytochemicals. The qualitative phytochemical analysis showed that alkaloid, tannin, phenol and flavonoids were present in the extracts of the stems, roots and leaves of both plants. Glycoside was only absent in the leaves of *Sclerocarya birrea* while saponin was absent in the root of *Sclerocarya birrea* and the leaves and stems of *Steculia setigera.* The comparative quantitative analysis carried out using UV-visible spectroscopy, showed that the plants are rich in phytochemicals and tannins, flavonoids and saponins (1.92±0.05, 50.33±0.03 and 2.77±0.010 mg/dl respectively) were found to be higher in Kem than those in Yola (1.73±0.09, 22.14±0.08, and 1.78±0.08 mg/dl respectively). Alkaloids, phenols and glycosides from Kem (3.47±0.01, 19.94±0.05, 0.54±0.03 mg/dl respectively) were lower compared to those from Yola (3.95±0.00, 22.19±0.06 and 0.85±0.06 mg/dl respectively). The phytochemical composition of the stem, roots and leaves of the plants indicate their medicinal properties.

Keywords: *phytochemical, tannin, alkaloid, flavonoid, Sclerocarya birrea, Steculia setigera*

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1. Introduction

According to the World Health Organization [1], a medicinal plant is any plant which in one or more of its organs contains substances that can be used for therapeutic purposes or which are precursors for the synthesis of useful drugs. Overtime, these important flora species have been collected from the wild and used for their medicinal activities in local traditional medicine, but little is known about their conservation status. The World Health Organization redefined traditional medicine as comprising therapeutic practices that have been in existence, often for medicine and are still in use today. These practices vary widely in relation to the social and cultural heritage of different countries. According to Sofowora [2], the practitioners of traditional medicine could serve as additional sources of health manpower in developing countries such as Nigeria. This is especially so where a developing country is trying to achieve total health coverage for her people. Sofowora [2] also noted that traditional medicine enjoys a wider acceptability among the people of developing countries partly due to the inaccessibility of orthodox medicine, but the major contributing factor is the fact that it blends readily into the socio-cultural life of the people in whose culture it is deeply rooted. In fact, it is reported that 60-85 % of the population in every country of the developing world relies on traditional or indigenous forms of medicine.

Sclerocarya birrea is a savannah tree, belonging to the family anacardiaceae, with a rounded plum-like pale yellow fruit of 3-4 cm in diameter (resembling a mango fruits) when ripe with a juicy mucilaginous flesh, borne in profusion in late African summer to mid-winter [3]. *S. birrea* has a variable fruit size, approximately 15-25 g [4]. *Sclerocarya birrea* is deciduous and mainly dioecious, although there have been reports of monoecious trees. It is a medium sized tree reaching heights of between 7 and 17 m, with grey fissured bark, stout branch lets and pale foliage. The leaves are compound, pinnate and the flowers greenish-white or reddish [3]. Its leaves are alternate and compound, crowded near the ends of the branches. The leaflets are dark green above and a lighter blue–green below and are ovate to elliptic in shape. The edges of coppice leaves are toothed and often tinged with pink. The leaves are divided into 10 or more pairs of leaflets, each about 60 mm long, dark-green above, and sharp point. The flowers are borne in small, oblong clusters. Male and female flowers occur separately, usually but not always on

separate trees. The flowers are small, with red sepals and yellow petals. The rough stem-bark is flaky, with a mottled appearance due to contrasting grey and pale-brown patches. It grows in a wide variety of soils but prefers well-drained soil. It exists at altitudes varying from sea level to 1800 m and annual rainfall range of 200–1500 mm. Its major habitat limitation is probably its sensitivity to frost [5].

The plant, *Sterculia setigera* (family: Sterculiaceae) is known by different indigenous cultural communities in Nigeria: Hausa– "Kukuki"; Fulani– "bo'boli"; Yoruba– "Ose-awere" [6]. It is a savannah tree, widespread in savannah areas of tropical Africa. The seeds are with yellow aril and the tree is found in open savannah woodlands, often characterized by stony hills. This plant is used in traditional medicine by various indigenous communities. For instance, the Yoruba people of Nigeria use a black soap prepared from black powder obtained from burnt mixture of the fruits and seeds in the treatment of dermatosis [6]. Phytochemical screening of the roots, stems and leaves of plant indicates the presence of alkaloids, carbohydrates, saponins, phenols, tannins, terpenoids and flavonoids which are known to possess medicinal and pesticidal properties [6]. Over the years, the use of complementary and alternative medicine in both rural and urban areas across Nigeria has increased, but there is a great concern for its safety, efficacy as well as control and this poses a great challenge for health authorities and the general public [7].

2. Materials and Method

2.1. Area of Study

Kem, in Shelleng Local Government Area is located in the South-Eastern geographical zone of Adamawa State between latitude $9^0$3" - $10^0$34"N and longitude $11^0$33" - $12^0$55" E at an altitude of 800 m above sea level and annual rainfall between 750 - 1100 mm within the northern guinea savannah sub-humid region [8]. Yola is the capital city and administrative center of Adamawa State and is located on the Benue River between latitude $9^0$48" N and longitude $12^0$36" E.

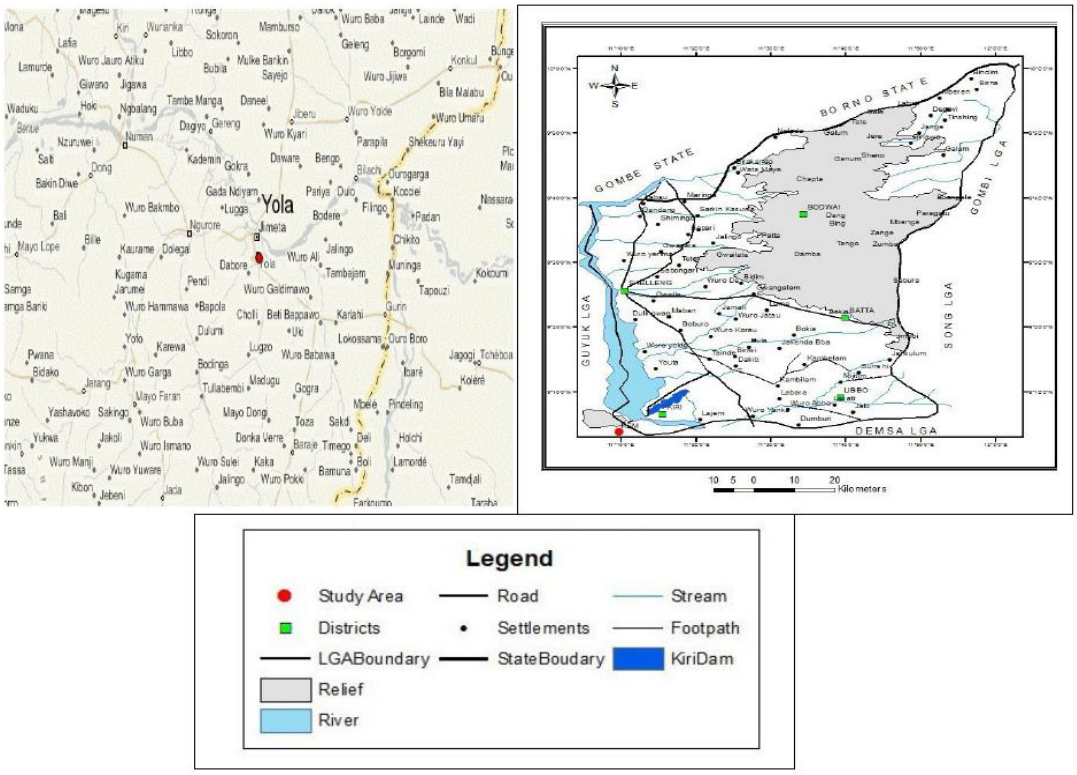

Figure 1. Map of Yola and Shelleng Lcal Government Area, Adamawa State, Nigeria, showing study areas

Figure 2. The appearance of *Sterculia setigera*

Figure 3. The appearance of *Sclerocarya birrea*

2.2. Collection of the Plant Materials

The roots, stems and leaves of *Sclerocarya birrea*, and *Steculia setigera* were collected from Kem, Shelleng Local Government Area, Adamawa State, Nigeria, and were dried for 14 days at room temperature and ground into uniform powder using a mortar.

2.3. Preparation of the Extract

The ground roots, stems and leaves of the plants materials were sieved to obtain fine powders from which the extract was prepared. Methanolic extract of the plant were obtained by taking 300 g of either the powdered roots, stems or leaves in a separate container and 20 mL of solvent was added to it. The contents were shaken vigorously to dissolve the sample material in the solvent, the mixture was then filtered through Whatman filter paper, and the filtrate was evaporated in an oven at a temperature of 40℃ to obtain the crude extract [9,10].

2.4. Qualitative Phytochemical Screening

Phytochemical test were carried out on leaves, roots, and stem extracts of Sclerocarya birrea, and Steculia setigera for the identification of saponins, flavonoids, phenols, tannins, alkaloids and glycoside. The aforementioned phytochemical screening, was carried out according to the method adopted by Okpako and co researchers [11], and Trease and Evans [12].

2.5. Quantitative Phytochemical Screening

2.5.1. Determination of Total Alkaloid

Alkaloids were quantitatively determined according to the method employed by Okpako and co researchers [11]. 50 mL of 10 % acetic acid in ethanol was added to 5 g powder plant sample covered and allowed to stand for 4 h. The filtrate was concentrated on a water bath to ¼ of its original volume. Concentrated ammonium hydroxide was added drop wise to the extract until the precipitation was complete and the whole solution was allowed to settle. The collected precipitate was washed with dilute ammonium hydroxide and then filtered. The residue was dried and thereafter weighed. The alkaloid content was determined using the formula:

$$\% \text{ Alkaliod} = \frac{finalweight\ of\ sample}{Initialweight\ of\ extract} \text{x}100. \qquad (1)$$

2.5.2. Determination of Total Phenol Content

The fat free sample was boiled with 50 mL of ether for the extraction of the phenolic component for 15 minutes. 5 mL of the extract was taken into a 5 mL flask, then 10 mL of distilled water was added to 2 mL of ammonium hydroxide solution and 5 mL of concentrated amyl alcohol added the sample was left for 30 minutes for colour development. This was then analyzed using the UV-visible spectrophotometer (JENWAY 6320D) at 505 nm [13].

2.5.3. Determination of Total Saponin

Determination of saponin was done following the method of Poorima and Ravishankar [14]. 5 g of fine powder was dispersed in 50 mL of 20 % ethanol prepared in distilled water and the mixture was heated in a water bath for at 55℃ for 4 h with regular stirring. The residue collected after filtration was re-extracted with another 50 mL of 20 % ethanol and reduced to 20 mL over hot water bath at 100℃. The concentrated solution obtained was shaken vigorously with 10 mL of diethyl ether in a separatory funnel. Sodium chloride was added to the mixture and the whole mixture was heated to evaporation and thereafter dried in an ovum at 40℃. The saponin content was determined with the formula:

$$\% \text{ Saponins} = \frac{\text{weight of final filtrate}}{\text{weight of sample}} \text{x}100. \qquad (2)$$

2.5.4. Determination of Total Flavonoids

Total flavonoid content was determined using the method of Kumaran and Karunakaran [15]. 2 mL of plant extract (1 mg/mL) was mixed with 2 mL of $AlCl_3$ with 0.5 mL of the extract from the resultant mixture. The absorbance was measured at 420 nm using UV-visible spectrophotometer.

2.5.5. Determination of Tannin Content

Dried plant material (0.5 g) was extracted with 300 mL of diethyl either for 20 h at room temperature. The residue was boiled for 2 h with 100 mL of distilled water and then allowed to cool and filtered. The extract was adjusted to a volume of 100 mL in a volumetric flask. The content of tannins in the extract was determined both calorimetrically using Folin-Denis reagent and by measuring the absorbance of blue complex at 760 nm [16].

2.5.6. Determination of Cardiac Glycoside Content

Cardiac glycoside content in the sample was evaluated using Buljet's reagents (containing 95 mL aqueous picric acid and 5 mL 10 % aqueous NaOH). 1 g of the fine power of sample was soaked in 10 mL of 70 % ethanol for 2 h and then filtered. The extract obtained was purified using lead acetate solution before the addition of freshly prepared Buljet's reagent. The difference between the intensity of colours of the experimental absorbance is proportional to the concentration of the glycosides.

3. Results and Discussion

Table 1 shows the result of qualitative phytochemical analysis of *S. birrea and Sterculia setigera.* The leaves, stems and roots of *S. birrea* and *Sterculia setigera* all contain tannins, flavonoids, alkaloid and phenols. Saponins were found to be absent in the root of *Sclerocarya birrea* and leave stems of *S. setigera.* Glycoside was found to be absent only in the leaves of *Sclerocarya birrea*.

Preliminary phytochemical screening on medicinal plants is important in the detection of bioactive principles which is a new source of therapeutically and industrially valuable compounds that may lead to the discovery of new drugs and development of such. The investigation of qualitative phytochemicals in Table 1 for *Sclerocarya birrea* and *Sterculia setigera* show the presence of tannins,

flavonoids, alkaloids, phenol, saponin and cardiac glycoside in their leaves, stems and roots, indicating their potential for medicinal application. The results obtained in this study for the qualitative phytochemical analysis of the plants are in agreement with the previous study of Louis e*t al.*, *[9]* and those of other researchers [10,11] who had reported the presence of secondary metabolites in ethanolic extract of *S. birrea*.

3.1. Results of Phytochemical Composition of the Leaves, Stem and Roots of Sclerocarya Birrea and Sterculia Setigera from Kem

From the present investigation of phytochemical content, flavonoid has the highest content of the phytochemicals and is found in the leaves of *Sclerocarya birrea*, ranging from 2.84±0.07 to 50.33±0.03 mg/dl. Phenol was the second in content after flavonoids the highest content was found in the stems of *Sclerocarya birrea* (19.94±0.05 mg/dl), and glycoside was the least in content, the content rages from 0.08±0.00 to 0.54±0.03 mg/dl. The highest composition of tannin was found in the root of *S. birrea*, ranging from 1.92±0.05 to 0.08±0.04 mg/dl, alkaloid content ranged from 0.98±0.00 to 3.47±0.01 mg/dl, with its highest concentration recorded in the stems of *S. setigera*. For saponins, the highest content was found in the stems of *Sclerocarya birrea*, ranging from 0.69±0.03 to 2.77±0.05 mg/dl.

Figure 4 shows the mean composition of phytochemical content in each plant. There is significant difference between the composition of the phytochemicals - phenol, saponin and flavonoid - which are higher in *S. birrea* compared to the composition in *Sterculia setigera*. The high content of these compounds in *S. birrea* might be the reason why people use it for curing of many ailments in Nigeria. The difference in photochemical composition depends on the biological character of each plant such as living form, morphology and with environmental factors and also the plant age. This work is in agreement with the previous work of Hsouna *et al.* [17] who reported that even plants growing in the same environment might have different phytochemical contents.

3.2. Results of Phytochemical of the Leaves, Stem and Roots of Sclerocarya Birrea and Sterculia Setigera from Yola

The results in Figure 5 show the phytochemical content of the leaves, stem and roots of *Sclerocarya birrea* and *Sterculia setigera* colected from Yola. It can be seen that the composition of the tannins ranged from 0.83±0.03 to 1.73±0.09 mg/dl, flavonoids content ranged from 1.10±0.07 to 22.14±0.08 mg/dl, and alkaloids content ranged from 2.36±0.00 to 3.95±0.00 mg/dl. The composition of saponins ranged from 0.47±0.02 to 1.78±0.05 mg/dl, phenols content ranged from 8.71±0.20 to 22.19±0.06 mg/dl and glycoside content ranged from 0.11±0.03 to 0.85±0.06 mg/dl.

Table 1. Qualitative phytochemical screening of *S. birrea* and *Sterculia setigera*

Plant sample	Tannins	Flavonoids	Alkaloids	Phenol	Saponin	glycoside
Sclerocaryabirrea leave	+	+	+	+	+	-
Sclerocaryabirrea stems	+	+	+	+	+	+
Sclerocaryabirrea root	+	+	+	+	-	+
Steruliasetigera leave	+	+	+	+	-	+
Sterculiasetigera stems	+	+	+	+	-	+
Sterculiasetigera root	+	+	+	+	+	+

Key; += present, - = absent.

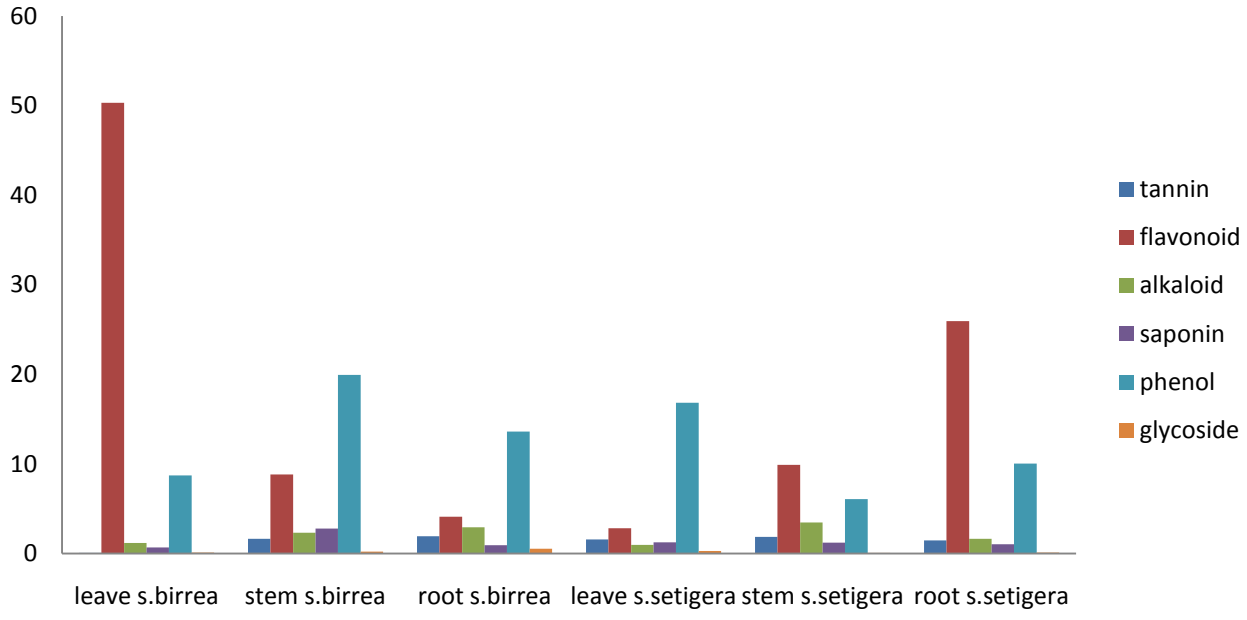

Figure 4. Phytochemical composition (mg/dl) of *Sclerocarya birrea* and *Sterculia setigera* (leaves, stem and roots)

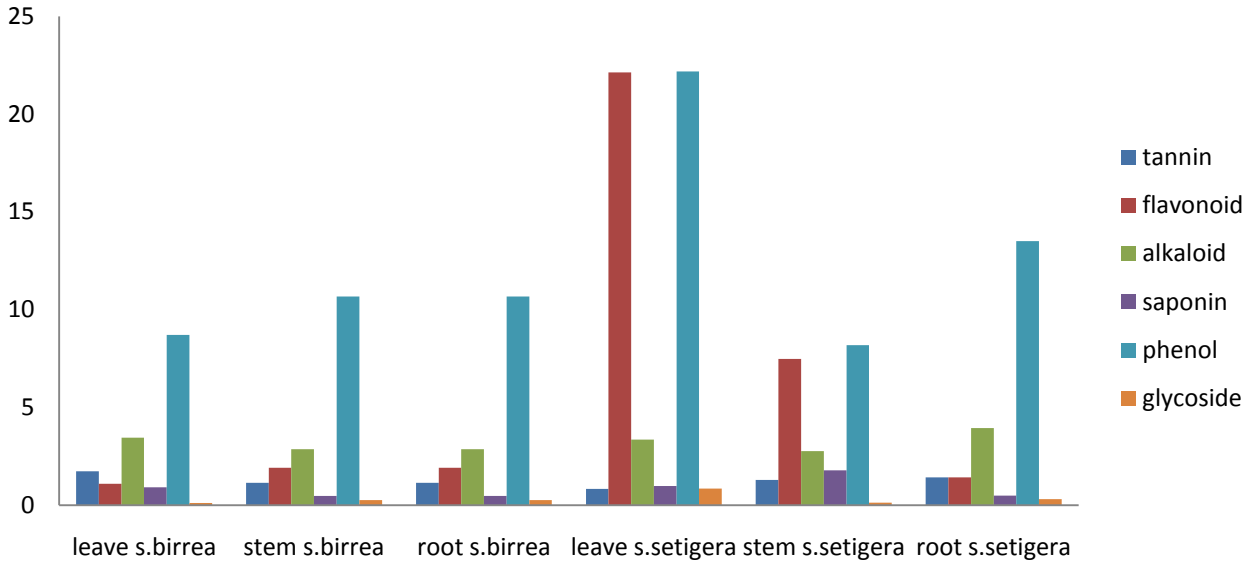

Figure 5. Phytochemical composition (mg/dl) of *Sclerocarya birrea* (leave, stem and root) and *Sterculia setigera* (leave, stem and root) from Yola

It can also be seen in Figure 5 that the content of flavonoid, phenol, glycoside and alkaloid are higher in *Sterculia setigera* than in *Sclerocarya birrea*. This variation in content might be as a result of the solvent used for extraction, age of the plant, and it may also be as a result of the biological character such as living form and/or morphology because there are different species of the plant, and environmental factors such as altitude edaphic factor [18]. However, plant structure and living form play important roles in the determination of phytochemical compounds.

3.3. Comparison of the Phytochemical Composition of Tannin in the Leaves, Stem and Roots of *Sclerocarya birrea* and *Sterculia setigera* from the Two Locations (Kem and Yola)

The results presented in Figure 6 for the composition of tannin in both plants from the two locations show that the composition of tannin from Kem ranged from 0.08 ± 0.04 to 1.92 ± 0.05 mg/dl and 1.48 ± 0.06 to 1.86 ± 0.05 mg/dl and from Yola it ranged from 1.14 ± 0.02 to 1.73 ± 0.09 mg/dl and 0.83 ± 0.03 to 1.43 ± 0.02 mg/dl for *S. birrea* and *S. setigera* respectively.

Tannins are known to be organic substances of diverse composition with pronounced astrigen properties that promote the healing of wounds and inflamed mucous membrane [19]. Tannins also have the potential to complex divalent ions such as zinc iron etc, resulting in their unavailability and have been reported to form complexes with digestive enzymes, thereby reducing the digestibility in food [18]. In Figure 6, the significant difference in the composition of tannin in the plants got from Kem and Yola may be as the result of the geographical locations and the environmental condition of the plants, also the variation in the composition might be due to the fact that plants from Kem are located along a spring which helps in dissolving minerals from the rocks, unlike the plants from Yola which are on flat lands and which experience dry season. The presence of tannins in *Sclerocarya birrea* proved why it is recommended for wide range of treatment including liver and kidney diseases, hypertension, diuretics, diarrhea, and dysentery [20].

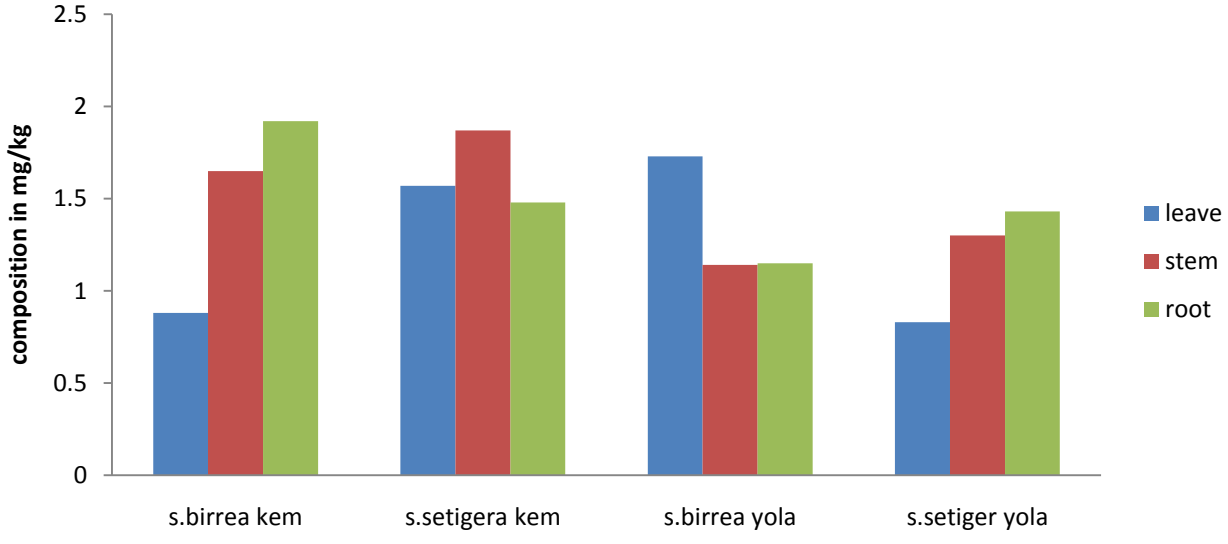

Figure 6. Tannin composition in *Sclerocarya birrea* and *Sterculia setigera* from the two locations (Kem and Yola)

3.4. Comparison of the Phytochemical Composition of Flavonoids in the Leaves, Stem and Roots of *Sclerocarya birrea* and *Sterculia setigera* from the Two Locations (Kem and Yola)

Figure 7 shows that the composition of flavonoids from Kem ranged from 4.11 ± 0.06 to 50.33 ± 0.03 mg/dl and from 2.04 ± 0.09 to 25.94 ± 0.06 mg/dl and from Yola, it ranged from 1.10 ± 0.07 to 1.92 ± 0.06 mg/dl and 1.43 ± 0.05 to 22.14 ± 0.08 mg/dl for S. birrea and S. setigera respectively

Flavonoids have the highest content in all the investigated phytochemicals of the plants. This may be the reason why the plants have antibacterial and antimalarial function [21]. Flavonoids are also known to performed many functions such as antimicrobial and antiviral abilities [9]. Figure 7 also shows that the highest content of flavonoid was found in leave of the plants. Flavonoids content was generally higher in the plants from Kem than those in Yola. The difference in composition might be due to the fact that plants in Kem are located along a spring water and rocks. Factors such as edaphic soil water, soil air, and vegetation may have strong influence of the concentration of phytochemical composition of the plants. It can also be seen in Figure 7 that the highest flavonoid composition from the plants in Yola was found in the leaves of *sterculia setigera*. The large amount of flavonoids in all the plants investigated showed that the plants may have biological functions such as protection against allergies, inflammation, free radical and platelet aggregation, ulcers, virus and tumor [9,22].

3.5. Comparison of the Phytochemical Composition of Saponin in the Leaves, Stem and Roots of *Sclerocarya birrea* and *Sterculia setigera* from the Two Locations (Kem and Yola)

Figure 8 shows the comparison of saponins composition in the plants got from Kem and Yola. In Figure 8, the saponin content ranged from 0.69 ± 0.03 to 2.77 ± 0.05 mg/dl and 1.05 ± 0.05 to 1.26 ± 0.00 mg/dl for the plants got from Kem and from Yola, it ranged from 0.47 ± 0.02 to 0.91 ± 0.03 mg/dl and 0.49 ± 0.00 to 1.78 ± 0.05 mg/dl for *S. birrea* and *S. setigera* respectively.

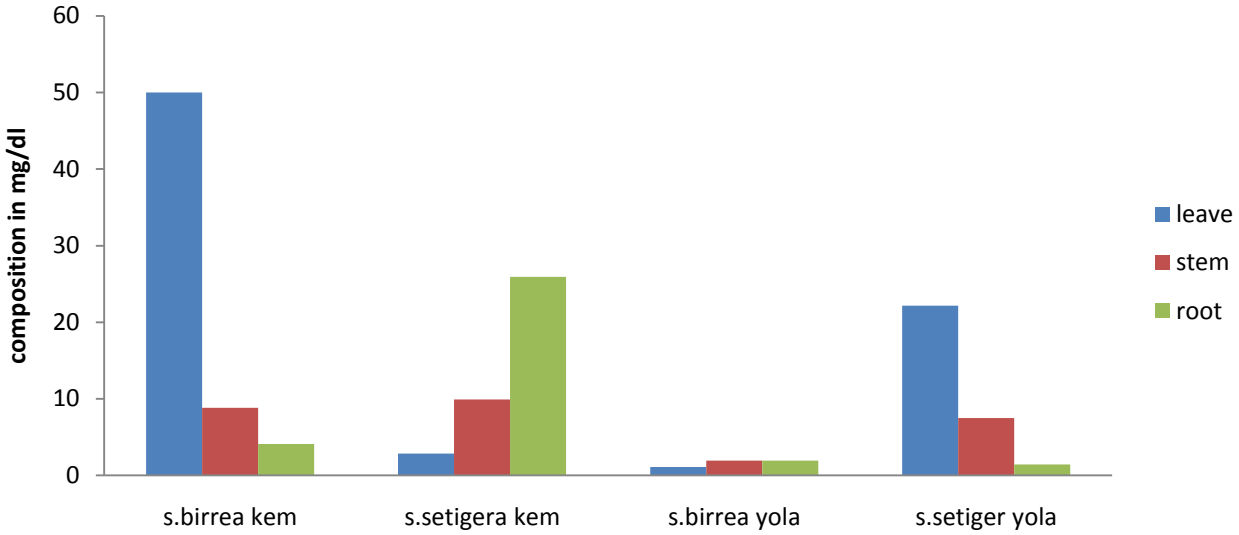

Figure 7. Flavonoid composition in *Sclerocarya birrea* and *Sterculia setigera* from the two locations (Kem and Yola)

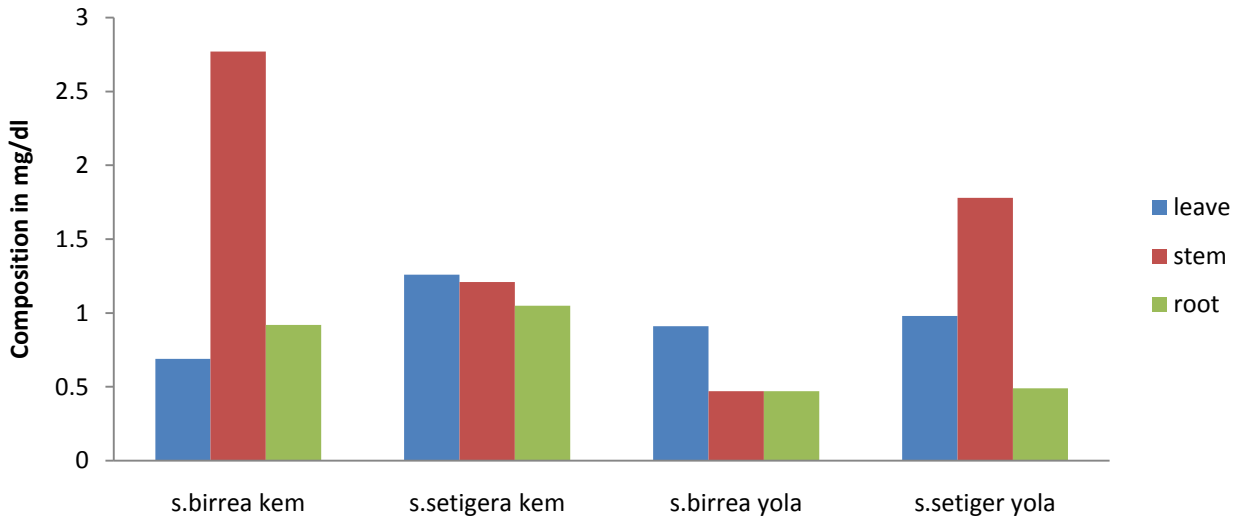

Figure 8. Saponin composition in *Sclerocarya birrea* and *Sterculia setigera* from the two locations (Kem and Yola)

Saponin has the property of precipitating and coagulating red blood cells. Its characteristics also include cholesterol binding and saponin serves as natural antibiotic which helps the body to fight infections and microbial invation [22]. In Figure 8, the highest content of saponin was found in the stems of *sclerocarya birrea* from Kem, while the stems of *sterculia setigera* had the highest saponin content in Yola. The reason for such variation might be due to period of time of collection, environmental conditions such as temperature, rainfall, soil mineral vegetation, and the geographical locations. The low content of saponin agreed with the opinion of Houghton *et al* [23], who reported that saponin is in trace quantity in plants.

3.6. Comparison of the Phytochemical Composition of Alkaloids in the Leaves, Stem and Roots of *Sclerocarya birrea* and *Sterculia setigera* from the Two Locations (Kem and Yola)

Figure 9 shows the comparison of alkaloids composition in the plants got from Kem and Yola. From Kem, alkaloid content ranged from 1.17 ± 0.10 to 2.94 ± 0.02 mg/dl and 0.98 ± 0.00 to 3.47 ± 0.01 mg/dl, and from Yola, it ranged from 2.86 ± 0.06 to 3.46 ± 0.01 mg/dl and 2.36 ± 0.00 to 3.95 ± 0.00 mg/dl for S. abirrea and S. setigera respectively.

Alkaloids are basic natural products occurring primarily in plants. They occur as one or more heterocylic nitrogen atoms and are generally found in the form of salts with organic acid. Alkaloids are the most efficient therapeutically significant plant substance. Pure isolated alkaloids and their synthetic derivatives are used as basic medicinal agents because of their analgesics and antibacterial properties. Figure 9 also shows that the alkaloid content from Yola is higher when compared to those from Kem. The highest content of alkaloid was found in the root and leave of *S. setigera*. This variation in content might be as result of the geographical location, mineral composition, and vegetation.

3.7. Comparison of the Phytochemical Composition of Phenol in the Leaves, Stem and Roots of *Sclerocarya birrea* and *Sterculia setigera* from the Two Locations (Kem and Yola)

Figure 10 shows the comparison of phenol composition in the plants from Kem and Yola. As can be seen in Figure 10, the phenol content in the plants got from Kem ranged from 8.71 ± 0.20 ± to 19.94 ± 0.05 mg/dl and 6.07 ± 0.03 to 16.82 ± 0.01 mg/dl, and from Yola, it ranged from 8.71 ± 0.20 to 10.67 ± 0.04 mg/dl and 8.19 ± 0.08 to 22.19 ± 0.06 mg/dl for *S. birrea* and *S. setigera* respectively.

The presence of phenolic compound in the plant prove that they have both antimicrobial and antifugal effects [24]. Plants that contain phenol could be used as immune enhancers and hormone modulators. Phenols are also known to have the ability to block specific enzymes that cause inflammation, thus preventing diseases [22]. Figure 10 also shows that the highest content of phenol was found in the leaves of *Sclerocarya birrea* from Yola compared to those from Kem. These variations are due to a number of environmental factors such as climate, altitude, rainfall, and adaphic conditions [25]. The results obtained in this study for the phenolic content of the plants and the explanation for the difference in phenol content of the plants based on their locations, are in agreement with those of Hsouna *et al*, [17] who reported that the ethanolic extract of *P. graveolens* grown in Kodaikanl, showed a higher level of phenol which slightly differs from *P. graveolens* extracts studied in Tunisia.

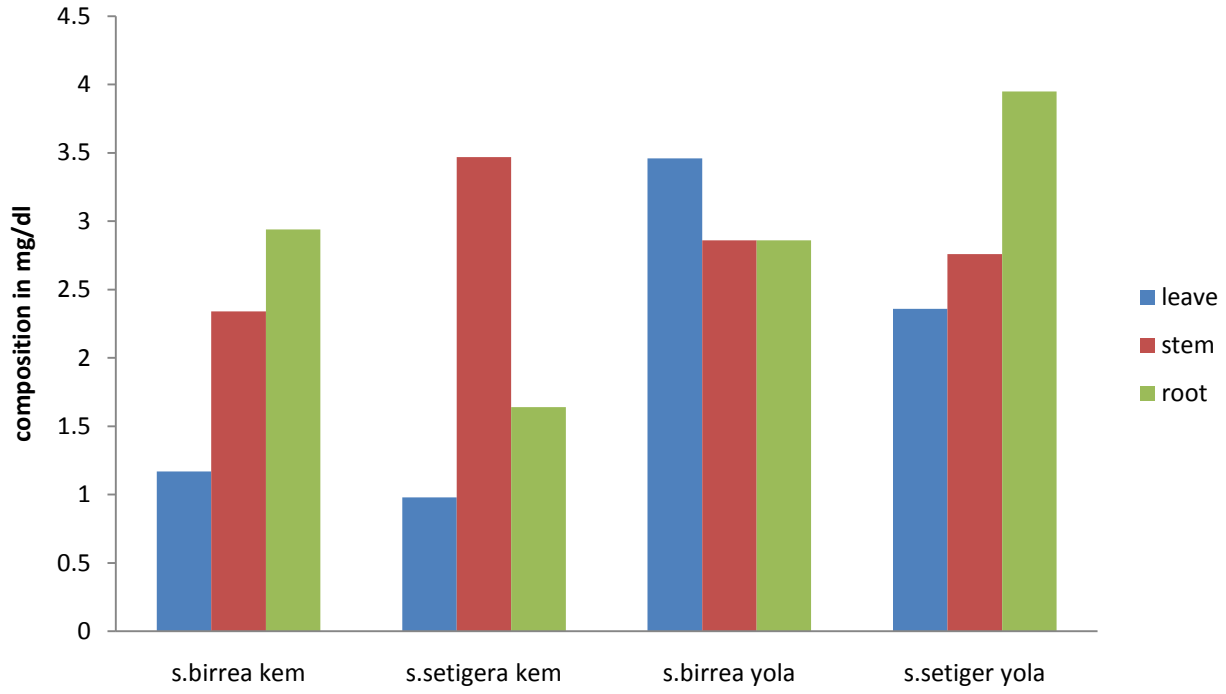

Figure 9. Alkaloid composition in *Sclerocarya birrea* and *Sterculia setigera* from the two locations (Kem and Yola)

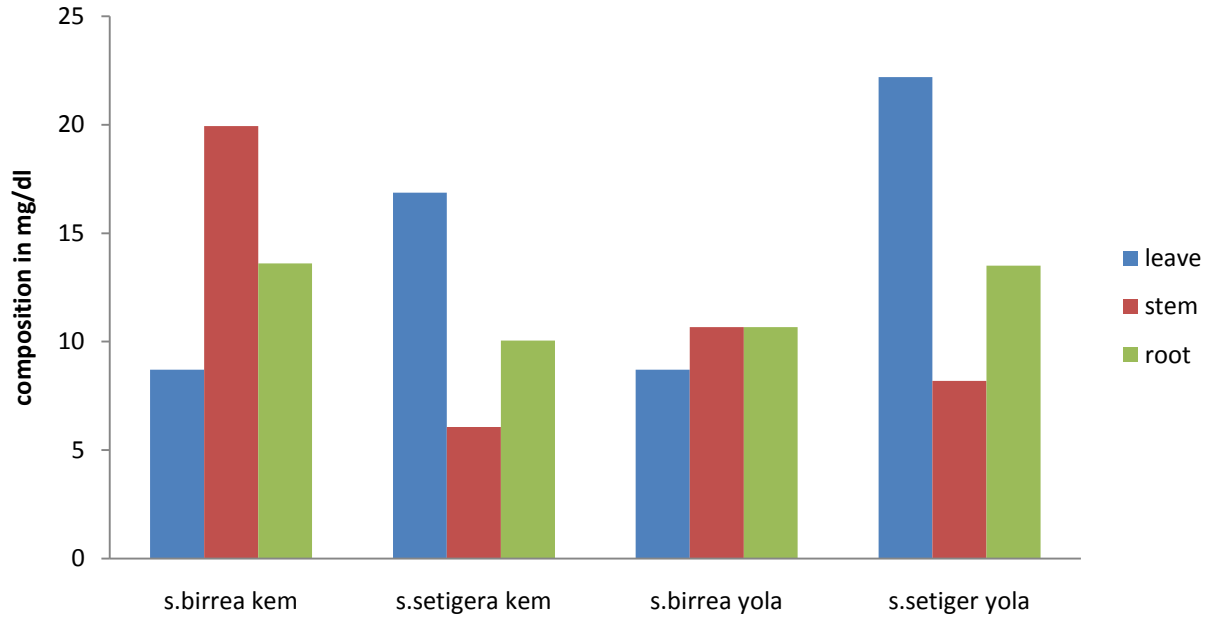

Figure 10. Phenol composition in *Sclerocarya birrea* and *Sterculia setigera* from the two locations (Kem and Yola)

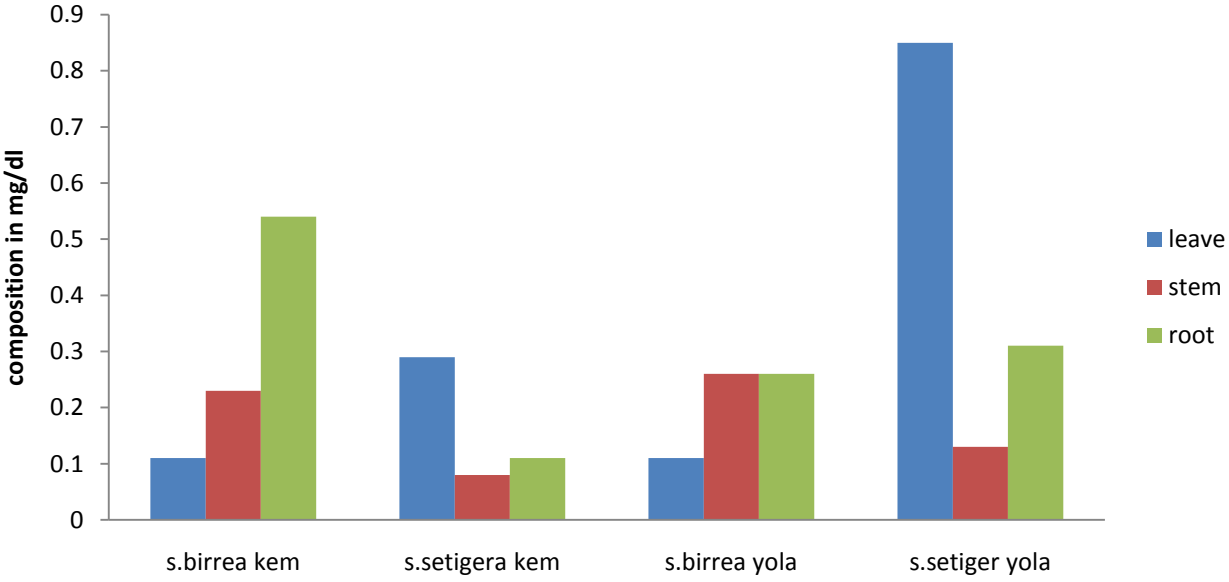

Figure 11. Glycoside composition in *Sclerocarya birrea* and *Sterculia setigera* from the two locations (Kem and Yola)

3.8. Comparison of the Phytochemical Composition of Glycoside in the Leaves, Stem and Roots of *Sclerocarya birrea* and *Sterculia setigera* from the Two Locations (Kem and Yola)

Figure 11 shows that the comparison of glycoside from Kem ranged from 0.11 ± 0.03 to 0.54 ± 0.03 mg/dl and 0.08 ± 0.00 to 0.29 ± 0.01 mg/dl, and from Yola, it ranged from 0.11 ± 0.03 to 0.26 ± 0.34 mg/dl and 0.13 ± 0.04 to 0.85 ± 0.06 mg/dl for S. birrea and S. setigera respectively.

The rapentic uses of cardiac glycoside involve the treatment of cardiac failure and their utility results from and increased cardiac output by increasing the force of heart contraction [26]. In Figure 11, the content of glycoside varied, the highest content was found in the leaves of *S. setigera* from Yola and the lowest content was found in the leaves of *S. birrea* from Kem. Glucoside content was the least among the phytochemicals studied and this variation in content might be due to geographical location of the plants.

4. Conclusion

Phytochemical composition of both plants varied in their contents - flavonoid and phenol were found to be higher from both locations. Our results show that both plants got from the two locations have potential for antibactericidal and antifungicidal activities. Results obtained from this study propose that the plants may be used for consumption by humans or utilized on the basis of preparation of herbal products. Data from this study also reveals that the plants have the potential to act as sources of useful drugs because of the presence of various

compositions of phytochemical constituents. However, the composition of phytochemical contents and antimicrobial activities of the plants for treatment of various diseases as claimed by people are also being investigated.

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Statement of Competing Interests

The authors declare no competing interests in this study.

References

[1] World Health Organization (WHO) (2001). Legal status of traditional medicine and complimentary/alternative medicine: a worldwide review. WHO Publishing, 189.

[2] Sofowora, A. (1993). Medicinal plants and traditional medicine in Africa.2nd Edition. Spectrum Books Limited, sunshine House, Ibadan, Nigeria, 289.

[3] Dieye, A. M., Sarr, A., Diop, S. N., Ndiaye, M., Sy, G. Y., Diarra, M., Rajraji Gaffary, I.,Dimo, T., Rakotonirina, S. V., Tan, P. V., Azay, J., Dongo, E., Kamtchouing, P., andCros, G. (2007). Effect of *Sclerocarya birrea* (Anacardiaceae) stems bark methylenechloride/methanol extract on streptozotocindiabetic rats. *J Ethnopharmacol.*, 110(3): 434-438.

[4] Shackleton, S.E., Shackleton, C.M., Cunningham, T., Lombard, C., Sullivan, C. and Netshiluvhi, T. (2002). Knowledge on *Sclerocarya birrea* subsp. *caffra* withemphasis on its importance as a non-timber forest product in South and southern

[5] Wynberg, R., Cribbins, J., Leakey, R., Lombard, C., Mander, M., Shackleton, S. E.,Sullivan, C. A. (2002). A summary of knowledge on *Sclerocarya birrea* subsp.*caffra* with emphasis on its importance as a nontimber forest product in Southand southern Africa. Part 1: Taxonomy, ecology, traditional uses and role inrural livelihoods. *Southern African Forestry Journal*, 196: 67-78.

[6] Tor-Anyiin, Akpuaka, M.U. and Oluma, H.O.A. (2011). Phytochemical and antimicrobial studies on stem bark extract of *Sterculia setigera*, Del. *African Journal of Biotechnology*, 10(53): 11011-11015.

[7] Soladoye, M.O., Adetayo, M.O., Chukwuma, E.C., Owa, F.P. (2012). An 'avalanche' of plant species for the traditional cure of diabetes mellitus in South-Western Nigeria. *Journal of natural product and Plant Resources*, 2(1): 60-72.

[8] Adebayo, A.A. and Tukur, A.L. (1999). Adamawa State in maps publication Department of Geography, Federal University of technology Yola, in Co-operate with paraclete publications. A division of paraclete and sons Nigeria.

[9] Louis, H., Maitera, O.N., Boro, G. and Barminas, J.T. (2017). Determination of total phenolic content and some selected metals in extracts of *Moringaoleifera, Cassia tora, Ocimumgratissimum, Vernoniabaldwinii and Telfairiaoccidentalis* plant leaves. *WNOFNS* (11): 11-18.

[10] Pigwe, A.S., Loius, H., Innocent, A.J. and Oyebanji, O. (2017) Evaluation of heavy metals concentration in selected medicinal plants (*Sterculiasetigera*Del. and *Sclerocaryabirrea* (A. rich.) Hochst) collected from Bwabul Spring, Bambuka and Jalingo low-lands, Taraba State. *Journal of Environmental Analytical Chemistry*, 4(4): 2-5.

[11] Okpako, E. C., Louis, H., Magu, T.O., Akwo, J. K., Akakuru, O. U., Bisong, E.A. (2017). Phytochemical screening and proximate nutritional analysis of brown leaves of Indian almond (*Terminaliacatappa L*). *International Journal of Scientific and Research Publications*, 7(3): 141-144.

[12] Trease, G.E. and Evans, W.C. (1989). A text book of pharmaconosyBaillereTindall Ltd, London.

[13] Edeoga, H., Okwu, D. and Mbaebie, B. (2005). Phytochemical constituents of some Nigerian medicinal plants. *African Journal of Biotechnology*, 4(7): 685-688.

[14] Poornima, G.N. and Ravishankar, F.V. (2009) Ealuation of phytonutrients and vitamin content in a wild yam, *Dioscorea belophylla* (Prain) Haines. *African Journal of Biotechnology*, 8(6): 971-973.

[15] Kumaran, A. and Karunakarn, R.J. (2002). Antioxidant and free radical scavenging activity of and aqueous extact of Coleus aromaticus. *Food Chemistry*, 97: 109-114.

[16] Anchna, C., Aphiwat, T. and Nuansri, R. (2005). Screening of antioxidant activity and antioxidant compounds of some edible plants of Thailand. *Food chemistry*, 92: 491-497.

[17] Hsouna, A.B. and Hamdi, N. (2012). Phytochemical compositton and antinicrobial activities of the assesntial oil and organic entracts from *pelargonium graveolens* growing in Tunisia. *Lipids in Health and Disease*, 11: 167-174.

[18] Kokate, C.K., Purohit, A.P. and Gokhale, S.B. (2004). Practical pharmacognosy 2nd edition Vallabhprakashan, New Delhi 466-470.

[19] Frantisek, S. (1998). The natural guide to medicinal Herbs and plants Tiger books international Plc Twickenham Uk, pp 14.

[20] Heyde, H. (1990). Medicinal plants in suriname. Uity stiching Gizondheids plante informaite. pp 157.

[21] Dakoro, F.D. (1995). Plant flavonoids Biological molecules for useful exploitation. *Australian Journal of Plant Physiology*, 22: 87-99.

[22] Okwu, D.E. (2005). Phytochemicals, vitamins and mineral contents of two Nigerian medicinal plants. *International Journal of Molecular Medicine and Advance Sciences*,1(4): 375-381.

[23] Houghton, P. J., Woldmariam, T. Z., O'shea, S. and Thyagarajan, S. P. (1996). Two securinega-type alkaloids from *Phyllanthusamanus.* P*hytochemistry*, 43: 715-717.

[24] Huang, M.T. and Ferraro, T. (1992). Phenolic compounds in food and cancer prevention. In phenolic compounds in food in the effects of health II: antioxidants and cancer prevention, eds Huang, M.T., Ho, C.T. and Lee, C.Y., ACS Sympossium Series 507, American Chemical Society, Washington DC, pp 8-34.

[25] Kokate, C.K. Purohit, A.P. and Gokhale, S.B. (2004). Pharmacognosy, 30th Edn, Nirali Prakasham, Pune, pp. 593-597.

[26] Babula, P., Masarik, M. Adam, V., Provaznik, I. and Kizek, R. (2013). From Na+/K+-ATPase and cardiac glycoside to cytotoxicity and cancer treatment. *Anti-cancer Agents in Medicinal Chemistry*, 13(7): 1069-1087.

APPENDIX

Mean of Phytochemical Composition (mg/dl) of *Sclerocarya birrea and S. setigera* in Kem

Plant Sample	Tannins	Flavonoids	Alkaloids	Saponins	Phenols	Glycoside
Leave of *Sclerocaryabirrea*	0.08±0.04	50.33±0.03	1.17±0.10	0.69±0.03	8.71±0.20	0.11±0.03
Stems of *Sclerocaryabirrea*	1.65±0.02	8.82±0.04	2.34±0.52	2.77±0.05	19.94±0.05	0.23±0.05
Root of *Sclerocaryabirrea*	1.92±0.05	4.11±0.06	2.94±0.02	0.92±0.02	13.60±0.02	0.54±0.03
Leave of *Sclerocaryabirrea*	1.57±0.04	2.84±0.07	0.98±0.00	1.26±0.00	16.82±0.01	0.29±0.01
Stems of *S.setigera*	1.86±0.05	9.90±0.05	3.47±0.01	1.21±0.01	6.07±0.03	0.08±0.00
Root of*S.setigera*	1.48±0.06	25.94±0.06	1.64±0.04	1.05±0.05	10.05±0.06	0.11±0.01

Mean phytochemical Composition (mg/dl) of *Sclerocarya birrea* and *S. setigera* in Yola

Sample	Tannins	Flavonoids	Alkaloids	Saponins	Phenols	Glycoside
Leave of *Sclerocaryabirrea*	1.73±0.09	1.10±0.07	3.46±0.01	0.91±0.03	8.71±0.20	0.11±0.03
Stems of *Sclerocaryabirrea*	1.14±0.02	1.91±0.06	2.86±0.06	0.47±0.02	10.67±0.04	0.26±0.34
Root of *Sclerocaryabirrea*	1.15±0.02	1.92±0.06	2.86±0.06	0.47±0.02	10.67±0.04	0.26±0.34
Leave of *Sclerocaryabirrea*	0.83±0.03	22.14±0.08	2.36±0.00	0.98±0.01	22.19±0.06	0.85±0.06
Stems of *S.setigera*	1.30±0.01	7.48±0.04	2.76±0.00	1.78±0.05	8.19±0.08	0.13±0.04
Root of *S setigera*	1.43±0.02	1.43±0.05	3.95±0.00	0.49±0.00	13.51±0.07	0.31±0.40

Mean concentration of defferent phytochemicals in both locations

Plant Sample	Location	Tannins	Flavonoids	Alkaloids	Saponins	Phenols	Glycoside
Leave of *Sclerocaryabirrea*	Kem	0.08±0.04	50.33±0.03	1.17±0.10	0.69±0.03	8.71±0.20	0.11±0.03
Stems of *Sclerocaryabirrea*	Kem	1.65±0.02	8.82±0.04	2.34±0.52	2.77±0.05	19.94±0.05	0.23±0.05
Root of *Sclerocaryabirrea*	Kem	1.92±0.05	4.11±0.06	2.94±0.02	0.92±0.02	13.60±0.02	0.54±0.03
Leave of *Sclerocaryabirrea*	Kem	1.57±0.04	2.84±0.07	0.98±0.00	1.26±0.00	16.82±0.01	0.29±0.01
Stems of *S.setigera*	Kem	1.86±0.05	9.90±0.05	3.47±0.01	1.21±0.01	6.07±0.03	0.08±0.00
Root of *S.setigera*	Kem	1.48±0.06	25.94±0.06	1.64±0.04	1.05±0.05	10.05±0.06	0.11±0.01
Leave of *Sclerocaryabirrea*	Yola	1.73±0.09	1.10±0.07	3.46±0.01	0.91±0.03	8.71±0.20	0.11±0.03
Stems of *Sclerocaryabirrea*	Yola	1.14±0.02	1.91±0.06	2.86±0.06	0.47±0.02	10.67±0.04	0.26±0.34
Root of *Sclerocaryabirrea*	Yola	1.15±0.02	1.92±0.06	2.86±0.06	0.47±0.02	10.67±0.04	0.26±0.34
Leave of *Sclerocaryabirrea*	Yola	0.83±0.03	22.14±0.08	2.36±0.00	0.98±0.01	22.19±0.06	0.85±0.06
Stems of *S. setigera*	Yola	1.30±0.01	7.48±0.04	2.76±0.00	1.78±0.05	8.19±0.08	0.13±0.04
Root of *S. setigera*	Yola	1.43±0.02	1.43±0.05	3.95±0.00	0.49±0.00	13.51±0.07	0.31±0.40