INTRODUCTION
Phytochemicals are non-nutritive plant chemicals that have protective or disease preventive properties. They are non-essential nutrients, meaning that they are not required by the human body for sustaining life. It is well-known that plants produce these chemicals to protect themselves but recent research demonstrates that they can also protect against diseases (Breslin, 2017). There are more than thousand known phytochemicals, some of the well-known phytochemical are lycopene in tomatoes, isoavones in soy and flavonoids in fruits.

Phytochemicals are naturally present in many foods but it is expected that through bio-engineering new plants will be developed, which will contain higher levels of phytochemicals. This would make it easier to incorporate enough phytochemicals with our food (Breslin, 2017) (Molyneux et al, 2007) and (Harborne et al, 1998)).

Various medicinal properties have been attributed to natural herbs. Medicinal plants constitute the main source of new pharmaceuticals and health care products (Ivanova, et al, 2005). Extraction and characterization of several active phyto-compounds from these green factories has given birth to some high activity pharmaceuticals and health care products (Ivanova, et al, 1998)). Plant products have been part of phytomedicines since time immemorial. These can be derived from any part of the plant like bark, leaves, flowers, roots, fruits, seeds etc. (Cragg and Newman, 2003, Parekh and Chanda 2009).

Phytochemical screening of various plants is reported by many researchers (Mojab et al., 2003; Parekh and Chanda 2009). The plant Albizia chevalieri is a tree that grows up to 12 m high or a

<table>
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shrub under harsher conditions of the dry savannah from Senegal, Niger and Nigeria. It has an open and rounded or umbrella shaped canopy, bark pale-greyish, twigs pubescent with white lenticils, leaves with 8-12 pairs of pinnate and 20-40 pairs of leaflets each. The bark was reported to contain alkaloids and also tannins sufficient for use in tanning in Nigeria and Senegal. It is used in Borno-North eastern Nigeria as purgative, taenicide and also remedy for coughs. A decoction of leaves is used in Northern Nigeria as remedy for dysentery (Burkill, 1995; Le Houerou, 2009). There are also reports on the local use of the leaves extract for cancer treatment in Zaria city, Kaduna State.

Previous studies on methanol leaf extract of *Albizia chevalieri* against *Plasmodium berghei* model have indicated the presence of phenolic compounds with significant antiplasmodial activity (Hajara *et al.*, 2017). This research was designed to determine phytochemical constituents both qualitative and quantitative in *A. chevalieri*.

**MATERIALS AND METHODS**

**Plant collection, authentication and extraction**

The fresh leaves, stem bark and root of *Albizia chevalieri* was collected in the month of September, 2018 at Kurba -North, in Yamaltu-Deba local government area of Gombe State. It was taxonomically authenticated by a taxonomist at the herbarium unit of the Department of Biological Sciences, Gombe State University. A voucher specimen (649) was deposited there for future reference. The leaves, stem bark and the roots of *A. chevalieri* were washed under running tap water to eliminate dirt and other foreign particles that may be present, they were air-dried at room temperature (27 - 37 °C) away from direct sun light for three weeks and were later pulverized into coarse powder using a mortar and pestle, and into fine powder using an electric grinder, the plant material were then stored in an air-tight containers until use. Extraction was done via maceration using ethyl acetate, hexane and methanol, the macerates after the extraction process were filtered twice through cotton wool and through Whatman No.1 filter paper, the residue was then dried over absorbent layer with conc. NaOH to pH 12 and was extracted with CHCl3 (20 ml) thrice, the CHCl3 layer was pooled, and dried over absorbent layer with 1 N HCl and was kept overnight, the acidic solution was treated with 1 N NaOH and the tubes were placed in a boiling water bath for exactly one minute. The tubes were allowed to cool and the absorbance of each tube was read at 650 nm in a spectrophotometer against a reagent blank. Standard Gallic acid solutions (0.2-1 µg) corresponding to 2.0 – 10 µg concentrations was also treated as above. The concentration of phenols was expressed as µg/g.

**Qualitative Phytochemical Analysis**

The extracts were subjected to phytochemical screening to determine the classes of secondary metabolites present in the plant materials according to Brain & Turner, 1975 Trease and Evans (1983). These include: Alkaloids, Saponins, Tannins, Flavonoids, Anthraquinones and Steroids. The homogenate was centrifuged at 10,000 rpm for 20 minutes. The supernatants was pooled and evaporated to dryness over a water bath. The content in the crucible was cooled in a desiccator later transferred into a crucible and evaporated to dryness. The residue was then dissolved in a known volume of distilled water. Different aliquots were pipetted out and the volume in each tube was made up to 3.0 ml with distilled water. Folin-Ciocalteau reagent (0.5 ml) was added and equal volume of Na2CO3 and the tubes were placed in a boiling water bath for exactly one minute. The tubes were allowed to cool and the absorbance of each tube was read at 650 nm in a spectrophotometer against a reagent blank. Standard Gallic acid solutions (0.2-1 µg) corresponding to 2.0 – 10 µg concentrations was also treated as above. The concentration of phenols was expressed as µg/g.

**Estimation of Total Phenols**

The amount of total phenols in the tissues will be estimated by the method proposed by Mallick & Singh, 1980. The extract (0.5 g) was homogenized in 10 X volume of 80 % ethanol. The homogenate was centrifuged at 10,000 rpm for 20 minutes. The supernatants was pooled and evaporated to dryness. The residue was then dissolved in a known volume of distilled water. Different aliquots were pipetted out and the volume in each tube was made up to 3.0 ml with distilled water. Folin-Ciocalteau reagent (0.5 ml) was added and equal volume of Na2CO3 and the tubes were placed in a boiling water bath for exactly one minute. The tubes were allowed to cool and the absorbance of each tube was read at 650 nm in a spectrophotometer against a reagent blank. Standard Gallic acid solutions (0.2-1 µg) corresponding to 2.0 – 10 µg concentrations was also treated as above. The concentration of phenols was expressed as µg/g.

**RESULTS**

The fresh leaves, stem bark and root of *Albizia chevalieri* were collected in the month of September, 2018 at Kurba -North, in Yamaltu-Deba local government area of Gombe State. The qualitative phytochemical screening for secondary metabolites showed the presence of various phytochemicals in different extracts for each plant parts. Table 1, shows the presence of all the secondary metabolites in good amounts in the three parts of methanol extracts. In ethyl acetate extracts, Flavonoids, Alkaloids, steroids and Anthraquinones were present, cardiac glycosides was absent in the leaves of ethyl acetate extract, tannins was absent in the stem bark of ethyl acetate extract and saponins was present only in root of ethyl acetate extract, while absent in leaves and stem bark of ethyl acetate extract. N-hexane extracted flavonoids in all the plant parts, Alkaloids and cardiac glycosides were only present in the n-hexane leaves extract, while steroids and Anthraquinones were only present in stem bark of n-hexane extract.

<table>
<thead>
<tr>
<th>Phytochemicals</th>
<th>Leaves</th>
<th>S/bark</th>
<th>Root</th>
<th>Leaves</th>
<th>S/bark</th>
<th>Root</th>
<th>Leaves</th>
<th>S/bark</th>
<th>Root</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flavonoids</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Alkaloids</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
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<tr>
<td>Tannins</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
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<tr>
<td>Steroids</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Anthraquinones</td>
<td>-</td>
<td>-</td>
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<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Saponins</td>
<td>-</td>
<td>-</td>
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<td>-</td>
<td>-</td>
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</tr>
</tbody>
</table>

**Key:**

+ Positive
- Negative

**Determination of Flavonoids**

Flavonoids determination was by the method reported by Ejikeme *et al.*, 2014 and Boham and Kocipai (1994). The amount of total flavonoids in the tissues will be estimated by the method proposed by Mallick & Singh, 1980. The extract (0.5 g) was homogenized in 10 X volume of 80 % ethanol. The homogenate was centrifuged at 10,000 rpm for 20 minutes. The supernatants was pooled and evaporated to dryness over a water bath. The content in the crucible was cooled in a desiccator later transferred into a crucible and evaporated to dryness. The residue was then dissolved in a known volume of distilled water. Different aliquots were pipetted out and the volume in each tube was made up to 3.0 ml with distilled water. Standard Gallic acid solutions (0.2-1 µg) corresponding to 2.0 – 10 µg concentrations was also treated as above. The concentration of phenols was expressed as µg/g.

**Estimation of Total Alkaloids**

Exactly 50 ml of 80 % aqueous methanol was added to 2.50 g of sample in a 250 ml of sample in a 250 ml 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 (125 mm) was used to filter whole solution of each extract. Each filtrate was later transferred into a crucible and evaporated to dryness over a water bath. The content in the crucible was cooled in a desiccator and weighed until constant weight was obtained. (Okwu, 2004). The percentage of flavonoid was calculated as:

\[ \text{percent of flavonoid} = \left( \frac{\text{weight of flavonoid}}{\text{weight of sample}} \right) \times 100 \]

**Table 1:** Qualitative Phytochemical Screening in Three Parts of *Albizia chevalieri* Extracted Using Methanol, Ethyl acetate and N-hexane

<table>
<thead>
<tr>
<th>Phytochemicals</th>
<th>Methanol</th>
<th>Ethyl acetate</th>
<th>N-hexane</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leaves</td>
<td>S/bark</td>
<td>Root</td>
<td>Leaves</td>
</tr>
<tr>
<td>Flavonoids</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Alkaloids</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Tannins</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Steroids</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Anthraquinones</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Saponins</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**Key:**

+ Positive
- Negative
of the major active ingredients found in plant based medicines. Tannins are formed by polymerization of quinone units, which is one respectively. The leaves, stem bark and root of A. chevalieri in this study were shown to contain glycosides which could be exploited for their medicinal properties. Alkaloids are generally toxic to other organisms. They often have pharmacological effects and are used as medications, antimicrobial, and hypotension agent, local anesthetic and stimulant, antibacterial, anticancer, antiasthma, and antimalarial (Verma et al., 2010). The presence of alkaloids in A. chevalieri confirms its uses as antimalarial drug (Hajara et al., 2017). Alkaloids and Tannins may also contribute to the plants effects as antimalarial, anti-diarrhea and analgesic agent. Alkaloids are one of the major classes of natural products that exhibit antimalarial activity. Indeed, quinine, the first antimalarial drug, belongs to this class. Over 1000 alkaloids from higher plants were reported to demonstrate significant antimalarial activity in studies published from 1990-2000; some of these were more potent than chloroquine (Saxena et al., 2003). It was observed after quantifying Alkaloids as seen in Table 2 that methanol root extract is having the highest Alkaloids contents (55.08 %), followed by leaves methanol extract (46.94 %), stem bark ethyl acetate extract, root ethyl acetate extract, leaves ethyl acetate extract, and stem bark methanol extract were having 25.72 %, 21.34 %, 16.30 %, and 10.78 % respectively. Terpenoids are large class of naturally occurring organic compounds and are major constituents of plant resin essential oil extracted from plants. Terpenoids with most promising antimalarial properties are summarized with their chemical structures. A. chevalieri methanol leaf extract was found to possess good amount of terpenoids which agrees with the work of (Hajara et al., 2017). Saponins are being used commercially as dietary supplements and nutraceuticals. They are expected to lead to hydrolysis of glycoside from terpenoids and hence reduce the toxicity associated with the intact molecule (Verma et al., 2010). Appreciable quantities of saponins are found in the leaves, stem bark and root and A. chevalieri as shown in Table 1. Pharmacologically important phytochemicals in different plant parts of A. chevalieri were quantified, total phenolic content was found to be in good amounts. The root methanol extract showed maximum phenolic content as 44.48 µg GAE/g, followed by leaves methanol extract (33.69 µg GAE/g) and stem bark methanol extract (33.69 µg GAE/g). Root ethyl acetate extract (8.19 µg GAE/g), stem bark ethyl acetate extract (13.49 µg GAE/g), and leaves ethyl acetate extract (23.66 µg GAE/g), while n-hexane extracts were having a very low phenolic content with; n- hexane root (0.66 µg GAE/g), n-hexane stem bark extract (2.69 µg GAE/g), and n-hexane leaves extract (7.80 µg GAE/g) Table 2. Appreciable amount of phenolic compounds were found in the methanolic leaf extract of A. chevalieri (Hajara et al., 2017).

CONCLUSION

The secondary metabolites are present in significant amounts in the various organic extracts of the 3 different plant parts, hence the methanolic extracts were found to contain high amounts of these secondary metabolites than the rest of the extracts of ethyl acetate

**Table 2: Phytochemical Composition in Three Parts of Albizia chevalieri Extracted Using Methanol, Ethyl acetate and N-hexane**

<table>
<thead>
<tr>
<th>Samples</th>
<th>Total Alkaloids (g/100 g)</th>
<th>Total Phenols (µg GAE/g)</th>
<th>Flavonoids (g/100 g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leaves Methanol</td>
<td>46.94</td>
<td>33.69</td>
<td>22.00</td>
</tr>
<tr>
<td>Leaves E.acetate</td>
<td>16.30</td>
<td>23.66</td>
<td>4.17</td>
</tr>
<tr>
<td>Leaves N-hexane</td>
<td>-</td>
<td>7.80</td>
<td>7.14</td>
</tr>
<tr>
<td>S/bark Methanol</td>
<td>10.78</td>
<td>33.69</td>
<td>44.83</td>
</tr>
<tr>
<td>S/bark E.acetate</td>
<td>25.72</td>
<td>13.49</td>
<td>19.05</td>
</tr>
<tr>
<td>S/bark N-hexane</td>
<td>-</td>
<td>2.96</td>
<td>16.67</td>
</tr>
<tr>
<td>Root Methanol</td>
<td>55.08</td>
<td>44.48</td>
<td>38.89</td>
</tr>
<tr>
<td>Root E.acetate</td>
<td>21.34</td>
<td>8.19</td>
<td>9.09</td>
</tr>
<tr>
<td>Root N-hexane</td>
<td>-</td>
<td>0.66</td>
<td>29.41</td>
</tr>
</tbody>
</table>

**Figure 1:** Shows Gallic Acid Graph (Phenolics)
and n-hexane. Their qualitative analysis revealed their presence where as their quantitative analysis give almost approximate idea for their quantity present. Pharmacologically important phytochemicals in different plant parts of *A. chevalieri* were quantified, total phenolic content was found to be in good amounts. The Root methanol extract showed maximum phenolic content as 44.48 µg GAE/g, followed by leaves methanol extract (33.69 µg GAE/g) and stem bark methanol extract (33.69 µg GAE/g). Root ethyl acetate extract (8.19 µg GAE/g), stem bark ethyl acetate extract (13.49 µg GAE/g), and leaves ethyl acetate extract (23.66 µg GAE/g), while n-hexane extracts were having a very low phenolic content with; n- hexane root (0.66 µg GAE/g), n-hexane stem bark extract (2.69 µg GAE/g), and n-hexane leaves extract (7.80 µg GAE/g) Table 2. This research result has established through the investigation of their phytochemistry that they have potential to be used as substituent of antimalarial as well as antibiotic drugs; the industries particularly pharmaceutical, may advance this study and bring out the best out of this plant.

**Acknowledgement**

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**REFERENCES**


