Antibacterial Activity of *Piliostigma Thonningii* Methanol Stem Bark Extract

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**ABSTRACT**

The study was carried out to determine the phytochemical screening and antibacterial activities (% inhibition) of methanol stem bark extract of *P. thonningii* plant. Preliminary phytochemical screening revealed the presence (+) of alkaloids, tannins, saponins, flavonoids, phenols and steroids while terpenoids, glycoside and proteins were absent (-). The antibacterial activity (% inhibition) was determined using the modified broth dilution method. The result revealed that the extract significantly inhibited *S. aureus*, *S. typhi* and *P. aeruginosa* at lower concentrations (2 - 6 mg/ml) compared to Azithromycin which inhibited the pathogenic test organisms at the higher concentrations (8 and 10 mg/ml) respectively. The result also revealed that *E. coli* and *B. cereus* was significantly inhibited by Azithromycin compared to the extract. The study showed that the extract has vital phytochemicals and potent antibacterial activity. This findings support the use of the plant locally as herbal medicine for treating bacterial diseases.

**Keywords:** Antibacterial activity, Phytochemical screening, *P. thonningii*, Azithromycin

**INTRODUCTION**

Medicinal plants have enormous importance to the health of individuals and communities. WHO, (2001) reported that herbs from medicinal plants serves the health needs of about 80% of the world’s population; especially for people in the vast rural areas of developing countries. Records shows that medicinal plants are rich in a wide variety of secondary metabolites such as alkaloids, flavonoids, tannins and terpenoids which have been found to have antibacterial properties (Edeoga et al., 2005). The therapeutic values of these medicinal plants have been documented to have some chemical substances that provide definite physiological action on the human body. Medicinal plants are documented to have fairly low occurrence of adverse reactions of plant preparations compared to orthodox drugs from pharmaceuticals, coupled with the affordability, less expensive which attributes to the public consumption and the consideration of medicinal plants as alternatives medicine to synthetic drugs (Nair et al., 2005). Records have shown that medicinal plants are widely used in developing countries and developed nations of the world as sources of drugs or herbs for various chemotherapeutic purposes (Alain et al., 2005). Reddy et al. (2001) and Adejuwon et al. (2011) reported that effects of medicinal plant extracts on human pathogenic bacteria have been studied by a very large number of researchers in different parts of the world.

*Piliostigma thonningii* is a plant used in many African countries for its therapeutic values. Djuma, (2003) reported that different part of the plant is used in the treatment of various diseases in humans and animals. *P. thonningii* roots and twigs were documented to use in the treatment of dysentery, wounds, respiratory ailments, snake bites, hookworms and skin diseases. The leaves are used in the treatment of wounds, chronic ulcers, diarrhea, toothache, gingivitis, cough and bronchitis. The stems, leaves or roots extracts are taken as cough medicine, whereas the stem extract as menorrhagia medicine. Phytochemicals such as alkaloids, flavonoids, saponins and tannins have been isolated from the leaves of *P. thonningii*. The leaves possessed antibacterial, antimicrobial and antioxidant activities (Alfred, 2013). Ighodaro et al. (2012) reported that the dry stem powder contain alkaloids, saponins, flavonoids and tannins while Egharevba et al. (2010) documented that carbohydrates, glycosides, flavonoids, tannins, saponins, balsams, volatile oil and terpenes have
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been isolated from the leaves of *P. thonningii*. In view of the above findings, this study aimed at determining the preliminary phytochemical screening and antibacterial activities of *P. thonningii* methanol stem bark extract.

**MATERIALS AND METHODS**

**Collection of Plant Material**

*P. thonningii* fresh stem was collected from around Sangere village, Girei Local Government Area, Adamawa State. Sangere is located on latitude 9° 11’ 15’’ N and longitude 12° 20’ 29’’ E, on the North bank of River Benue. It was taxonomically identified and authenticated in the Plant Science Department of Modibbo Adama University of Technology, Yola. The stem bark was washed, cut into small pieces and air dried in the laboratory for 7 days and thereafter made into powder using an electric blender. The coarse material was sieved using 0.3 mm Endicott sieve.

**Preparation of the Plant Extract**

Air dried and powdered plant material 300 g was extracted with methanol by cold extraction process for 24 h with intermittent stirring. The solvent extract was filtered using a sterilized Whatman filter paper No.1 to obtain a particle free extract. The solvent extract was concentrated by evaporation of the solvent at < 50°C using rotary evaporator and vacuum oven to obtain dry powder. The extract was stored until use.

**Qualitative Phytochemical Screening**

Qualitative phytochemical screening of the freshly prepared crude extract was tested for the presence of alkaloids, flavonoids, terpenoids, steroids, phenols, tannins, saponins, glycosides and proteins as described by Nweze et al., (2004) and Senthilkumar and Reetha, (2009).

**Table1. Preliminary Phytochemical Screening of *P. thonningii* Methanol Stem Bark Extract**

<table>
<thead>
<tr>
<th>Phytochemicals</th>
<th>Stem bark Extract</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alkaloids</td>
<td>+</td>
</tr>
<tr>
<td>Tannins</td>
<td>+</td>
</tr>
<tr>
<td>Saponins</td>
<td>+</td>
</tr>
<tr>
<td>Terpenoids</td>
<td>-</td>
</tr>
<tr>
<td>Flavonoids</td>
<td>+</td>
</tr>
<tr>
<td>Glycosides</td>
<td>-</td>
</tr>
<tr>
<td>Proteins</td>
<td>-</td>
</tr>
<tr>
<td>Phenols</td>
<td>+</td>
</tr>
<tr>
<td>Steroids</td>
<td>+</td>
</tr>
</tbody>
</table>

**Key: Present: +, Absent: -**

**Antibacterial Assay**

Antibacterial activity of *P. thonningii* stem bark extract was tested against five selected pathogenic organisms (*E. coli, S. aureus, S. typhi, B. cereus and P. aeruginosa*) Table 2. The result showed the percentage inhibition of the stem bark extract and Azithromycin on the test organisms. Azithromycin significantly inhibited...
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the activity of *E. coli* (Fig. 1) and *B. cereus* (Fig. 4) (14.69 ± 1.48 %, 37.50 ± 4.02 %, 42.05 ± 0.80 %, 59.66 ± 0.81 %, 64.21 ± 0.80 % and 28.82 ± 0.80 %, 40.40 ± 0.40 %, 44.92 ± 1.20 %, 56.20 ± 2.52 %, 62.72 ± 0.79 % respectively) at various concentrations used (2 mg/ml, 4 mg/ml, 6 mg/ml, 8 mg/ml and 10 mg/ml) compared to the stem bark extract. *S. aureus* (Fig. 2) and *S. typhi* (Fig. 3) was significantly inhibited (19.84 ± 1.06 %, 22.18 ± 1.04 %, 41.48 ± 0.39 % and 20.61 ± 0.76 %, 30.06 ± 0.41 %, 36.99 ± 0.37 % respectively) by the extract at various concentrations of 2 mg/ml, 4 mg/ml and 6 mg/ml compared to Azithromycin which inhibited (55.53 ± 1.23 %, 63.37 ± 0.82 % and 71.48 ± 1.11 %, 75 ± 1.22 % respectively) the organisms at concentrations of 8 mg/ml and 10 mg/ml. *P. aeruginosa* (Fig. 5) was significantly inhibited (36.37 ± 0.57 %, 39.88 ± 0.53 %, 42.02 ± 1.17 % and 44.55 ± 0.49 %) by stem bark extract at concentrations 2 mg/ml, 4 mg/ml, 6 mg/ml and 8 mg/ml compared to Azithromycin which inhibited (55.46 ± 2.04 %) the organism at the highest concentration. The antibacterial activity indicated that the plant extract inhibited the test organisms (*S. aureus, S. typhi* and *P. aeruginosa*) at lower doses while the Azithromycin inhibited them at higher concentrations. *E. coli* and *B. cereus* was completely inhibited by Azithromycin at various concentrations used compared to the stem bark extract.

**Figure1.** Effect (% Inhibition) of *P. thonningii* stem bark extract and Azithromycin on *E. coli*. Each value is expressed as Mean ± SD, n = 5, (p < 0.05).

**Figure2.** Effect (% Inhibition) of *P. thonningii* stem bark extract and Azithromycin on *S. aureus*. Each value is expressed as Mean ± SD, n = 5, (p < 0.05).

**Figure3.** Effect (% Inhibition) of *P. thonningii* stem bark extract and Azithromycin on *S. typhi*. Each value is expressed as Mean ± SD, n = 5, (p < 0.05).
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**Figure 4.** Effect (% Inhibition) of *P. thonningii* stem bark extract and Azithromycin on *B. cereus*. Each value is expressed as Mean ± SD, n = 5, (p < 0.05).

**Figure 5.** Effect (% Inhibition) of *P. thonningii* stem bark extract and Azithromycin on *P. aeruginosa*. Each value is expressed as Mean ± SD, n = 5, (p < 0.05).

**Table 2.** Antibacterial activity (% Inhibition) of Piliostigma thonningii Stem bark Extract

<table>
<thead>
<tr>
<th>Concentration (mg/ml)</th>
<th>E. coli</th>
<th>S. aureus</th>
<th>S. typhi</th>
<th>B. cereus</th>
<th>P. aeruginosa</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stem bark extract</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>11.68 ± 0.49</td>
<td>19.84 ± 1.06*</td>
<td>20.61 ± 0.76*</td>
<td>10.28 ± 0.88</td>
<td>36.37 ± 0.57*</td>
</tr>
<tr>
<td>4</td>
<td>29.88 ± 0.56</td>
<td>22.18 ± 1.04*</td>
<td>30.06 ± 0.41*</td>
<td>19.43 ± 0.97</td>
<td>39.88 ± 0.53*</td>
</tr>
<tr>
<td>6</td>
<td>34.02 ± 1.09</td>
<td>41.48 ± 0.39*</td>
<td>36.99 ± 0.37*</td>
<td>26.28 ± 0.73</td>
<td>42.02 ± 1.17*</td>
</tr>
<tr>
<td>8</td>
<td>35.05 ± 0.99</td>
<td>45.53 ± 0.71</td>
<td>41.04 ± 0.34</td>
<td>28.57 ± 0.70</td>
<td>44.55 ± 0.49*</td>
</tr>
<tr>
<td>10</td>
<td>44.24 ± 0.86</td>
<td>50.97 ± 0.32</td>
<td>55.85 ± 0.61</td>
<td>37.71 ± 0.61</td>
<td>50.38 ± 0.44</td>
</tr>
<tr>
<td><strong>Azithromycin</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>14.69 ± 1.48</td>
<td>12.50 ± 0.41</td>
<td>18.40 ± 0.81</td>
<td>28.82 ± 0.80</td>
<td>14.12 ± 1.60</td>
</tr>
<tr>
<td>4</td>
<td>37.50 ± 4.02</td>
<td>13.20 ± 3.03</td>
<td>21.77 ± 1.52</td>
<td>40.40 ± 0.40</td>
<td>18.68 ± 1.22</td>
</tr>
<tr>
<td>6</td>
<td>42.05 ± 0.80</td>
<td>32.40 ± 2.24</td>
<td>23.57 ± 2.44</td>
<td>44.92 ± 1.20</td>
<td>41.95 ± 0.81</td>
</tr>
<tr>
<td>8</td>
<td>59.66 ± 0.81</td>
<td>55.53 ± 1.23</td>
<td>71.48 ± 1.11</td>
<td>56.20 ± 2.52</td>
<td>42.24 ± 1.21</td>
</tr>
<tr>
<td>10</td>
<td>64.21 ± 0.80</td>
<td>63.37 ± 0.82</td>
<td>75.00 ± 1.22</td>
<td>62.72 ± 0.79</td>
<td>55.46 ± 2.04</td>
</tr>
</tbody>
</table>

Values are expressed Mean ± SD (n = 5); * Significant increased (p< 0.05) compared to Azithromycin

**DISCUSSION**

Medicinal plants and dietary herbs were reported to have antimicrobial activities which are attributed to the presence of phenolic compounds. The presence of the phenolic compounds enhances the antimicrobial activity of these plants. Consequently, the medicinal potential of the plants lies in these chemical compounds that produce definite physiological action in the human body (Akinpelu et al., 2011). These phenolic compounds include phenolic acids, flavonoids, tannins, saponins, cardiac glycosides etc. The phytochemical screening of *P. thonningii* stem bark extract revealed the presence of phenols, alkaloids, flavonoids, saponins, steroids and tannins while proteins, glycosides and terpenoids are reported absent (Table 1). The results agree with findings by Dluya et al., (2015) for the presence of phenols, alkaloids, flavonoids, saponins, steroids and tannins in the leaf extract of *P. thonningii*. The presence of these compounds supports the traditional therapeutic use of the plant. Saponins are surface active agents which alter the permeability of the cell wall of organisms thus facilitating the entry of toxic materials or leakage of vital constituents from the cell (Daniu et al., 2010). Saponins are used as hypercholesterolemia, hyperglycemia, antioxidant, anticancer, antiinflammatory agents due to their detergent property (Ngbede et al.,...
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2008). The presence of saponins confirms the potential of the plant as potent antimicrobial agent. Tannin sacs are reported to be common in caesalpinioideae and exhibited antibacterial, antiviral and antitumor activities. Tannins are reported to inhibit HIV replication selectively and also used as diuretic (Evans, 2002). Daniyan et al. (2012) reported the presence of alkaloid to possess antibacterial, antiarrhythmic effect, antiinflammatory and anti-asthmatic actions. Alkaloids are also used as drug and the most common is quinine used as antimalaria drug. This confirms the antibacterial potential of P. thonningii stem bark extract for its antibacterial activity. The presence of flavonoids in the extract of the plant correspond to the report by Jimoh and Oladiji, (2005) and Daniyan et al., (2012) for the presence of flavonoids in the seeds and stem extracts of P. thonningii and for its antimicrobial activity. Our findings on the antibacterial activity of the plant extract agree with the report by Ighodaro et al., (2012) on the microbial activities P. thonningii leaves extracts against some selected pathogenic organisms. The report also showed that the leaves extract possess antibacterial activities. Dlua et al. (2015) also reported that methanol extract from the plant exhibited antibacterial activity. The antibacterial activities of P. thonningii stem bark extract are attributed to the presence of the various phytochemicals in the plant.

CONCLUSION

The result of this study showed the presence of various phytochemical in the stem bark extract of the plant P. thonningii. The stem bark extract exhibited antibacterial activity at the concentrations of the extract used. The presence of these phytochemical compounds such as flavonoids, alkaloids, saponins, tannins, steroids and phenols provides evidence for the use of the plant in traditional medicine for the treatment various ailments. More research needs to be carried on the plant to ascertain the real active ingredient responsible for its antimicrobial activity and therapeutic uses.

REFERENCES


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