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## Antidepressant Potentials of Aqueous Extract of *Voacanga africana* stept. ex Eliot (Apocynaceae) Stem Bark

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### ABSTRACT

A large number of the world's population suffer from depression and anxieties at some points in their life time, the sufferers are however sceptical about the available orthodox drugs largely because of side effects, cost and availability. This present study was aimed at evaluating the antidepressant potentials of *Voacanga africana* to query its ethno medicinal claim. The extract of the stem-bark of the plant was screened for its phytochemical composition, and antidepressant potentials assessed using forced swimming test (FST) and tail suspension test (TST). The results revealed presence of abundant alkaloids, but traces of saponin, terpenoid, cardiac glycosides with a meaningful antidepressant potentials at doses of 100 and 200 mg/kg by reducing the immobility duration in FST ( $46.19 \pm 1.212$  and  $23.96 \pm 1.14$  compared to the negative control  $79.06 \pm 0.16$  and positive control~imipramine  $24.13 \pm 0.405$ ), also increasing the swimming duration from  $159 \pm 0.416$  of the negative control to  $187.91 \pm 0.516$  and  $217.24 \pm 1.132$  seconds respectively. Similar trend was observed in the TST, where the immobility duration was reduced from  $183.207 \pm 5.157$  (negative control) to  $98.62 \pm 0.347$  and  $75.51 \pm 1.366$  for 100 and 200 mg/kg test drug compared to  $62.77 \pm 0.426$  secs (positive control). The ethno-medicinal claim of this plant is hereby justified.

#### Keywords

*Voacanga africana*,  
Antidepressant,  
Forced swim test,  
Tail suspension test,  
Phytochemicals

#### Article Info

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### Introduction

Medicinal plants may be considered nature's natural wonder drugs. Since the past decade, traditional medicine has become a topic of global importance in view of its vast potentials and the critical role it plays in healthcare delivery, especially in the urban and rural

areas where the larger percentage of the population resides (Anselm, 2006). In many African countries especially in sub Saharan Africa, it is estimated that about 80%-85% of the population utilize/depend on traditional medicine especially at primary health-care level [Nigeria Natural Medicine Development Agency, (NNMDA) 2009]. Thousands of

plants have been reported for their therapeutic effects against several illnesses ranging from cancer (Rajandeeep Kaur *et al.*, 2011) to stress (Tunde A Owolabi *et al.*, 2019).

*Voacanga africana* is a mesophytic, sap-woody, perennial shrub of the primary and secondary forest, within the Tropical Rain Forest and the Guinea Savannah woodland belt (Christopher and Nkechi, 2010). A mature *V. africana* crop does not grow more than 10 m height, lowly branched, stem, with smooth, grayish white bark. Slash exudes milky latex. Leaves have simple, petiolate and decussately arrangement. Depression is becoming one of the most widely growing mental illnesses in humans affecting millions of individual every year (Marcus *et al.*, 2012). In South Asia, including India, more than 50% of all the mental health related DALYs are related to depression (Baingana *et al.*, 2015).

Lately, alternative medicines and/or nutraceuticals have been promoted for treating depression and have found better patient acceptability due to lesser side effects, easy availability and lower cost (Thillaivanan and Samraj, 2014). Many herbal alcoholic extracts of plants such as *Centella asiatica*, *Hibiscus tilaceous*, *Moringa olifera* have shown antidepressant potential in experimental mouse model (Kaur *et al.*, 2015). Many plant products and botanicals such as *Foeniculum vulgare* (fennel) fruit (Singh, Sunil and Rana, 2013), *Phyllanthus amarus* (Wasnik, Singh and Alli, 2014), *Passiflora foetida*, popularly known as stinking passion flower (Santosh *et al.*, 2013).

## Materials and Methods

### Plant collection and processing

Stem bark of *V. africana* (Apocynaceae) was collected within the localities of Ewu, Ewu-Esan, Edo state of Nigeria in March 2016 and

authenticated at the Paxherbal Clinic and Research Laboratories herbarium where a sample specimen was kept with index number PAX/H/2051. The plant material was chopped, rinsed under running tap water to remove foreign objects, dried and pulverised into fine powder. 2 kg of the pulverised *V. africana* was macerated in 5 L of water, filtered and the filtrate concentrated into a brown syrupy mass on a water bath at temperature of 70 °C for 4 days. It was further dried in a hot air oven at 50 °C for two days and the semi-solid extract kept in a refrigerator for the analysis.

### Experimental animals

Albino Wistar rats of both sex (150-200 g) and Albino male Swiss mice (22-25g) were obtained from Paxherbal animal house, Ewu-Esan, Edo state, Nigeria. The animals were kept in cages under standard laboratory conditions (Relative humidity 55-65%, room temperature 25.0±2 °C and 12 h light/dark cycle) for two weeks prior to experimentation for adaptation with the laboratory conditions.

Animals were fasted overnight with free access to water prior to each experiment. Fourteen hours before the start of the experiment the animals were isolated and fed only with water *libitum*. Ethical approval was sorted and the experiments were performed in accordance with the rules of Institutional Animals Ethics Committee.

### Experimental animal grouping

Five groups (n=6 for each group) were used: Group 1 received 1 ml normal saline as the negative control, Group 2 received 1 ml Imipramine (30mg/kg) as positive control. Group 3, 4 and 5 received aqueous extract of varying doses (50, 100, and 200 mg/kg) respectively.

## Chemicals

All chemical used except Imipramine hydrochloride (Sigma Aldrich, St. Louis, USA) were obtained from Paxherbal Clinic and Research Laboratories and are of analytical grade.

## Phytochemical screening

Preliminary phytochemical screening of the powdered stem bark was performed for the presence of secondary metabolites using standard methods of John *et al.*, (2014).

## Forced swimming test

The forced swimming test was performed according to the method of Hritcu *et al.*, (2012) to evaluate the antidepressant effect of *V. africana* in rats. Animals were placed in cylindrical containers (10 × 45 cm) which were filled with water at 24-25 °C with a 30 cm depth and behaviours were monitored (Fig. 1). Normal saline and aqueous extract of *V. africana* bark were administered orally while imipramine was administered i.p 30 min prior to the test session. The duration of test was 6 min. After 2 min, immobility and swimming time was measured during the last 4 min. Immobility was assigned when no additional activity was observed other than that required to keep the animal's head above the water and swimming time assigned when animal did active movement of extremities and circling in the container.

## Tail suspension test

The tail suspension test (TST) was performed according to the method described by Steru *et al.* (1985). The mice were individually suspended 60 cm above the surface of table with an adhesive tape placed 1 cm away from the tip of the tail (Fig. 2). Immobility duration was recorded for the last 5 min during 6 min

by observers blind to the treatment conditions. Mice were considered immobile only when they hung passively and were completely motionless. Saline and aqueous extract of *V. africana* were administered orally while imipramine (30mg/kg) was administered via intraperitoneal one hour prior to test.

## Statistical analysis

The results were expressed as mean±S.E.M. The statistical significance was determined by One-Way Analysis of Variance (ANOVA). Followed by T-test  $P < 0.05$  was considered to be statistically significant.

## Results and Discussion

### Phytochemical screening

The phytochemical screening results revealed the presence of some bioactive compounds; abundant alkaloids, but traces of saponin, terpenoid, cardiac glycosides as presented in table 1.

### Effects on immobility and swimming times in rat using FST

The effect of Imipramine (30mg/kg i.p) and the aqueous extract of *V. africana* bark on immobility and swimming time in FST in rats as presented figure 1 and 2. The result obtained in this present study revealed an impressive antidepressant effect on rat and mice. Both TST and FST models of depression are widely used to screen new antidepressant drugs (Hritcu *et al.*, 2012), which are quite sensitive and relatively specific to all major classes of antidepressant drugs. With assessment in forced swimming test (FST), there was significant difference in immobility between low and high doses of the extract ( $p < 0.05$ ) with the most active dose of 200 mg/kg (23.96±1.14) comparable to the standard drug Imipramine at 30mg/kg

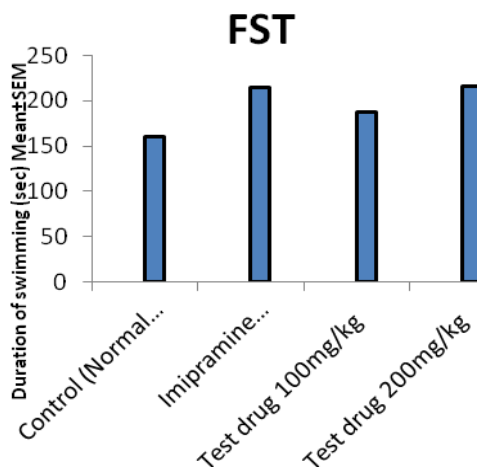
(24.13±0.405) and negative control group (79±0.042), while 50 and 100 mg/kg displayed relative activities of 58.44±0.511 and 46.19±1.212. Also, the swimming times were significantly extended: (negative control group 159±0.416), 200mg/kg test drug (217.24±1.132) comparable to the standard drug Imipramine at 30mg/kg (214.81±0.2582), while 50 and 100 mg/kg displayed relative activities of 176.32± 0.197 and 187.91±0.516.

**Table.1** Qualitative Phytochemical evaluation results of bark aqueous extract of *V. africana*

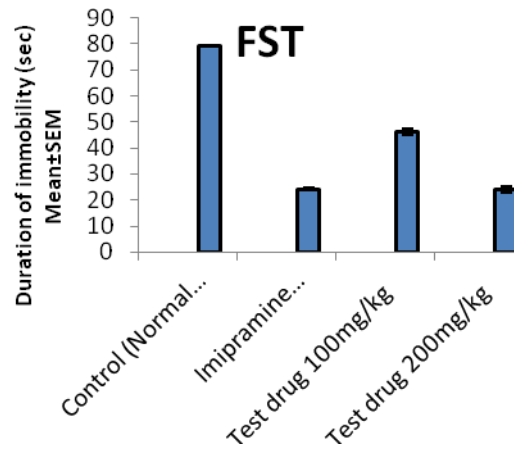
| S/N       | Phytochemical classes    | Bark aqueous extract of <i>V. africana</i> |
|-----------|--------------------------|--|
| <b>1</b>  | <b>Alkaloid</b>          |  |
|           | Dragendoff               | +++  |
|           | Mayer                    | +++  |
|           | Wagna                    | +++  |
| <b>2</b>  | <b>Cardiac glycoside</b> | +  |
| <b>3</b>  | <b>Flavonoid</b>         | -  |
| <b>4</b>  | <b>Saponin</b>           | -  |
| <b>5</b>  | <b>Starch</b>            | +  |
| <b>6</b>  | <b>Steroid</b>           | +  |
| <b>7</b>  | <b>Phlobatanin</b>       | -  |
| <b>8</b>  | <b>Reducing sugar</b>    | -  |
| <b>9</b>  | <b>Terpenoid</b>         | -  |
| <b>10</b> | <b>Tannin</b>            |  |
|           | Condensed                | -  |
|           | Hydrolysable             | -  |

+ = mildly present, ++ = moderately present, +++ = abundantly present, - = absent

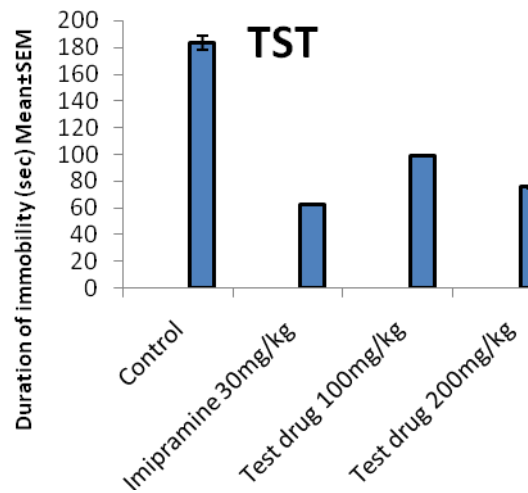
**Fig.1** The effect of imipramine and *V. africana* on swimming times in rat using forced swim test



**Fig.2** The effect of imipramine and *V. africana* on immobility times in rat using forced swim test



**Fig.3** Effect of imipramine and *V. africana* bark extract on tail suspension model in mice





### **The effect of imipramine and *V. africana* on TST**

The effect of Imipramine (30mg/kg i.p) and the aqueous extract of *V. africana* bark on tail suspension test in mice (TST) as shown in figure 3, administration of Imipramine (i.p) and the oral administration of the three different doses of aqueous extract (50, 100 and 200mg/kg) of *V. africana* is significant at  $p < 0.05$  by decreasing immobility ( $62.77 \pm 0.426$ ,  $165.3 \pm 19.3$ ,  $98.62 \pm 0.347$ ,  $75.51 \pm 1.366$ ) as compared with the control group ( $183.207 \pm 5.157$ ). The extract was able to induce antidepressant effects after oral administration of varying doses of *V. africana* bark extract with the highest dose (200 mg/kg) showing the highest immobility. The observed activity could be a justification for its consideration as an analgesic according to James *et al.*, (2007), as well as in the treatment of heart arches. Hence, from the above results it can be seen that among the three doses of the extract used, the most effective dose for antidepressant action using forced swim test is 200 mg/kg of *V. africana*. However, since 100mg/kg also showed significant antidepressant activities, it will be preferred to the higher dose because of high level of alkaloid which can have some level of toxicity.

In conclusion, the extract showed impressive antidepressant potential and this present study, as far as is known, is the first report of the antidepressant activities of the extracts of *V. africana*. This also justifies the ethno-medicinal usage of the plant.

### **Acknowledgement**

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