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Phytochemical Screening and Evaluation of Hypotensive Effect of Aqueous-Methanol Extract of *Sida ovata* on Normotensive Rats

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ABSTRACT

Medicinal plants have been used extensively for treatment of ailments including hypotension. This work is aimed at evaluating the phytochemicals present in extract of *Sida ovata* root and its hypotensive effect on normotensive rats. Results indicated the presence of alkaloids, tannins, phenols, flavonoids and steroids. Values of phenols, tannins, flavonoids and alkaloids were 8.8140 ± 0.0341 (GAE/g), 9.3430 ± 0.0393 (TAE/g), 5.8836 ± 0.0296 (GAE/g) and 1.5448 ± 0.0032 (AAE/g) respectively. Normotensive rats were administered varying doses of *S. ovata* extract and their Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), Mean Arterial Blood Pressure (MABP) and Pulse Pressure (PP)) levels were monitored over a specified period. There was a dose-dependent decrease in blood pressure following the administration of the *S. ovata* extract for all the parameters assessed. The SBP of the normal rat was 120.75 ± 0.7; administration of 100, 200, 400 and 800 mg/kg of the extract reduced the SBP to 114.25 ± 1.01868, 113.25 ± 0.62915, 108.50 ± 1.84842 and 108.25 ± 0.25000 respectively. Similar trends were observed for DBP, MABP and PP. *S. ovata* showed promising hypotensive effects in normotensive rats, indicating its potential as a therapeutic agent for managing blood pressure related diseases.

Keywords: Aqueous-methanol; Diastolic blood pressure; Systolic blood pressure; Dose-dependent; Extract; Hypotensive; Normotensive rat; Phytochemicals; Pulse pressure; *Sida ovata*.

1. Introduction

World Health Organization (WHO), viewed hypertension as elevated blood pressure levels above 140/90 mmHg. Hypotension on the other hand is a state of health where the blood pressure is below the acceptable normal level. It has been reported that about 1.4 billion adults within the ages of 30-79 years are hypertensive [1]. Hypertension is regarded as a silent killer and it is prevalent among the low and middle income nations of the world [1],[2]. Common symptoms of hypertension include but not limited to heart palpitations, headaches, ringing in ears, catching of breath after exertion, pressure to urinate frequently, fatigue, blurry vision, flushed face, dizziness and nosebleeds [3].

Medicinal plants have been used extensively either in the form of traditional medicine formulations or as pure active principles for treatment of various ailments. Interestingly, the positive effects of plants against pathogens have made it crucial to identify plants with useful therapeutic actions, leading to isolation and characterization of their active constituents [4]. Till date, medicinal plants are widely used in ethnomedicine around the world for treatment/management of ailments. In Nigeria particularly, traditional medicine recipes formulated from herbs are widely used as health care therapy. The effectiveness of these plants as therapeutic tools is attributed to the presence of some secondary metabolites, with potentials to produce specific physiological actions in the human body. Among these bioactive constituents of plants are alkaloids, tannins, flavonoids and phenolic compounds [5].

Findings of earlier researchers had shown that medicinal plants have found a common place in the treatment of hypertension [6],[7],[8]. This is attributed to availability of these remedies coupled with their cost-effectiveness, relative to synthesized drugs. Additionally, the common side effects characteristics of synthesized drugs are largely absent in herbs [3].

Sida ovata is a species of Malvaceae, grown in arid zone of tropical climatic regions, with wide spread in Northern Nigeria and India. It has been reported that roots of *S. ovata* species have demonstrated good therapeutic properties, with high nutritive values and are commonly used for treatment/management of tuberculosis, heart diseases, cough and respiratory diseases [9],[10],[11]. The present study is focused on evaluating the hypotensive activity of *S. ovata*, a medicinal herb used popularly in the Northern Nigeria for treatment of hypertension and other related diseases. Additionally, the present research is also aimed at screening for the phytochemical components of *S. ovata*. The study is also expected to cover the evaluation of the antioxidants, total flavonoids (TF) and total phenolic contents (TPC) of *S. ovata*.

1.1. Study Objectives

The specific objectives of this study were: (i) to carryout preliminary phytochemical screening of aqueous-methanol extract of *S. ovata*, (ii) to evaluate total phenolic content (TPC) of aqueous-methanol extract of *S. ovata*, (iii) to assess the total flavonoid content (TFC) of aqueous-methanol extract of *S. ovata*, (iv) to evaluate the antioxidant activity of *S. ovata*, and (v) to determine the hypotensive activity of *S. ovata* on normotensive rats.

2. Materials and Methods

2.1. Sample Collection

S. ovata roots were collected from Yankaba village in Kaura Namoda Local Government Area of Zamfara state, Nigeria in April 2024. It was taken to Biology laboratory, in the department of Science Laboratory Technology (SLT), Federal Polytechnic, Kaura Namoda for identification and authentication using standard procedures. A total of twenty (20) albino rats (100-120 g) were purchased from a dealer at Jos, Plateau State Nigeria in April 2024.

2.2. Sample Preparation

S. ovata roots were manually removed from the stem and washed under tap water. It was air dried at room temperature in Chemistry Laboratory of SLT department and pulverized using pestle and mortar. The pulverized sample was extracted using the method of [8] with minor modifications. In the present study, 1.0 kg of pulverized *S. ovata* sample was extracted with 50 % methanol in 2 L water by cold maceration for 72 hours with constant stirring. The extract was filtered and evaporated under reduced pressure to give concentrated extract. The concentrated extract was air dried under laboratory conditions. On the other hand, the albino rats were housed in cages at Biology Unit of SLT department and were given standard diet and tap water for 7 days acclimatization period.

2.3. Phytochemical Screening of *S. ovata* Extract

The aqueous-methanol extract of root of *S. ovata* was subjected to qualitative and quantitative phytochemical screening for the presence of secondary metabolites such as alkaloids, saponins, tannins, phenols, flavonoids, anthraquinones and steroids, using standard procedures [12].

2.4. Determination of Total Phenolic Content (TPC)

Total phenolic contents (TPC) in the root extract was determined by Folin–Ciocalteu colorimetric method as described by Singleton and Rossi [13] with some modifications. Standard gallic acid solution was prepared by dissolving 10 mg in 10 mL of methanol (1 mg/mL). Various concentrations of gallic acid solutions in methanol (25,

50, 75, and 100 µg/mL) were prepared from the standard solution. To each concentration, 5 mL of 10 % Folin–Ciocalteu reagent (FCR) and 4 mL of 7 % Na_2CO_3 were added making a final volume of 10 mL. The obtained blue coloured mixture was thoroughly shaken and incubated for 30 min at 40 °C in a water bath. The absorbance was measured at 760 nm against blank. The FCR oxidizes phenols in the extract and changes into dark blue colour and measured by UV-visible spectrophotometer. All experiments were carried out in triplicates, and the average absorbance values obtained at different concentrations of gallic acid were used to plot the calibration curve. Various concentrations of the extract (25, 50, 75, and 100 µg/mL) were prepared following the procedure described for standard gallic acid above and absorbance for each concentration of the extract was recorded. Total phenolic content of the extract was expressed as mg gallic acid equivalents (GAE) per gram of sample in dry weight (mg/g).

The total phenolic contents in all the samples were calculated by the using equation (1):

$$C = \frac{CV}{M} \quad ...(1)$$

where C = total phenolic content mg GAE/g dry extract, c = concentration of gallic acid obtained from calibration curve in mg/mL, V= volume of extract in mL, and m = mass of extract in gram.

2.5. Determination of Total Flavonoid Content (TFC)

Total flavonoid content (TFC) in the extract was determined by aluminum chloride colorimetric assay using the method of Zhishen *et al.* [14] with slight modifications. Stock solution (4 mg/mL) of quercetin was prepared by dissolving 4 mg of quercetin in 1 mL of methanol. The stock solution was diluted serially to make various concentrations of 0.25 mg/mL, 0.5 mg/mL, 0.75 mg/mL, and 1 mg/mL solutions. 1 mL of each quercetin solution was added to the test tube containing 4 mL of distilled water. At the same time, 0.3 mL of 5% $NaNO_2$ was added to the test tube and 0.3 mL of 10 % $AlCl_3$ was added after 5 min. This was followed by addition of 2 mL of 1 M NaOH to the mixture after 6 min. The volume of the mixture was made up to 10 mL by immediately adding 4.4 mL of distilled water. The absorbance of the various quercetin solutions were taken at 510 nm and used to plot calibration curve. Stock solution of 4 mg/mL of the extract in methanol was prepared and was diluted serially to make different concentrations (0.25 mg/mL, 0.5 mg/mL, 0.75 mg/mL, and 1 mg/mL) solutions. Similar procedure as described for quercetin was followed for the extracts also, and the absorbance was measured by spectrophotometer at 510 nm. Readings were taken in triplicate, and the average value of absorbance was used to calculate the total flavonoid content. The flavonoid content was expressed as quercetin equivalent (mg QE/g) using the linear equation based on the standard calibration curve.

2.6. Antioxidant Activities

The antioxidant properties of *S. ovata* aqueous-methanol root extract was evaluated using the combined methods of Sultana *et al.* [15] and Mohan *et al*. [16] with slight modifications. To the extract solutions of different concentrations, 1 mL DPPH solution was added and incubated at room temperature for 30 min in dark. A control was prepared by mixing 1 mL methanol and 1 mL DPPH solution. The absorbance of the extract solutions was measured by using a spectrophotometer at 517 nm. Ascorbic acid was used as the standard. 50 % inhibitory concentration (IC_{50} values) of the extract was calculated from graph of concentration against percentage inhibition.

Radical scavenging activity was expressed as percentage of inhibition. IC_{50} value is the concentration of sample required to scavenge 50 % of DPPH free radical. All measurements were taken in triplicate. IC_{50} of the extract indicates the concentration in which the radical scavenging potential is 50 %. The IC_{50} of the extract and standard were determined graphically.

The percentage of inhibition was calculated by using equation (2):

$$I\ \% = \frac{AC-AT}{AC}\ X\ 100\ \% \quad \ldots(2)$$

where AC = absorbance of the control (1 mL methanol + 1 mL DPPH solution), AO = absorbance of the sample solution, and I% = percentage of inhibition. The radical scavenging activities of the extracts are expressed in terms of their IC_{50} values. The data were presented as mean values ± standard deviation (n = 3).

2.7. Screening of Different Doses of *S. ovata* Extract for Hypotensive Effect in Normotensive Rats

The method of Alamgeer *et al.* [6] was adopted with slight modifications. In the present study, the 20 albino rats were divided into five groups (n = 4). Group I, II, III IV and V. Group I was not administered *S. ovata* extract and served as control. The blood pressure of normotensive albino rats (Group I) was noted using non-invasive blood pressure technique, during the acclimatization period. The values of the systolic blood pressure (SBP) i.e. pulse width and mean blood pressure (MBP) were obtained from pulse tracings, while the diastolic blood pressure (DBP) was calculated from SBP and MBP using equation (3) below.

$$DBP = \frac{3MBP-SBP}{2} \quad \ldots(3)$$

The experimental rats in Groups II, III, IV and V were orally administered 100, 200, 400 and 800 mg/kg doses of *S. ovata* extract, respectively for 21 days. All the rats were fed on standard diet. The blood pressure and heart rate of each of these groups were measured at 0, 3, 6, 9, 12, 15, 18 and 21 days using the procedure outlined above and the average taken.

2.8. Statistical Analysis

The data generated from the study were presented as mean ± SEM and were subjected to one-way analysis of variance (ANOVA), and statistical differences between the means were evaluated using New Duncan's Multiple Range Test at $P<0.05$.

3. Results and Discussion

3.1. Result of Phytochemical Screening

Table 1. Qualitative Phytochemical Screening of Aqueous-methanol Extract of *S. ovata*

Phytochemicals	Result
Alkaloids	+
Saponins	-
Tannins	+
Phenols	+

Flavonoids	+
Anthraquinones	-
Steroids	+

Key: + = present; ─ = not present

Table 1 presents the result of qualitative phytochemical screening of aqueous-methanol extract of root of *S. ovata*. The result indicated the presence of alkaloids, tannins, phenols, flavonoids and steroids while saponins and anthraquinones were absent. The presence of alkaloids and tannin in the extract of *S. ovata* suggest that the plant has the potentials of controlling blood pressure. It has been reported in literature that some alkaloids such as verticil and tetrandrine, extracted from *Rouvolfia verticillata* and *Stephania tetrandra* plants respectively have been used to regulate blood pressure [17]. Similarly, it has been reported that some bioactive compounds of tannin origin such as 1,2,3,6-tetra-O-galloyl-β-D-glucose and epigallocatechin-3-O-methylgallate have strong dose-dependent effect on hypertension, reducing blood pressure significantly [18].

Table 2. Quantitative Phytochemical Screening of Aqueous-methanol Extract of *S. ovata*

Phytochemicals	**Value**
Phenols (GAE/g)	8.8140 ± 0.0341
Tannins (TAE/g)	9.3430 ± 0.0393
Flavonoids (GAE/g)	5.8836 ± 0.0296
Alkaloids (AAE/g)	1.5448 ± 0.0032

Table 2 presents results of quantitative phytochemical analysis of aqueous-methanol extract of *S. ovata*. The aqueous-methanol root extract of *S. ovata* contains substantial quantities of phenols, tannins, flavonoids and alkaloids. The result is supportive of the vast usage of *S. ovata* plants among traditional medicine practitioners for treatment of several ailments.

3.2. Total Phenolic Content (TPC)

Total phenolic content (TPC) of the extract was calculated from the regression equation of the calibration curve ($Y = 0.1031x + 0.0214$; $R^2 = 0.9995$) and expressed as mg gallic acid equivalent (GAE) per gram of sample in dry weight (mg/g). The presence of considerably high quantity of phenolics (8.8140 ± 0.0341) in the root extract of *S. ovata* contributed significantly to its antioxidant properties. Interestingly, *S. ovata* plant is used in several traditional herbal medications for treatment of several diseases. The phenolic content of plants is directly related to their antioxidant properties. The present study corroborates with the findings in literature [19] that established that phenolic compounds act as reducing agents, hydrogen donors and are good free radicals scavengers.

3.3. Total Flavonoids Contents (TFC)

Similarly, the total flavonoids contents (TFC) of the aqueous methanol extract was calculated from the regression equation of the calibration curve ($Y = 0.1031x + 0.0214$; $R^2 = 0.9995$) and expressed as mg quercetin equivalents (QE) per gram of sample in dry weight (mg/g). The TFC values also showed similar trends with that of TPC values. Moderately high TFC value (5.8836 ± 0.0296 QAE/g) was obtained from the root extract as shown in Table 2. The

relatively high concentrations of phenols and flavonoids obtained in this study are attributable to the polarity of the solvents used for extraction and support its therapeutic utilization traditionally [16].

3.4. Antioxidant Activities

Antioxidant activity of the aqueous-methanol root extract of *S. ovata* was determined by 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay. DPPH free radical scavenging assay and their reducing power was determined on the basis of the concentration that effected 50 % inhibition (IC_{50}) of the free radicals.

Table 3. DPPH Antioxidant Activity of Aqueous-methanol Extract of *S. ovata*

Concentration	Absorbance test (AT)	1%
20mg	0.275	15.38
40mg	0.215	33.85
60mg	0.201	38.15
80mg	0.159	51.08
100mg	0.106	67.38
Absorbance control (AC)	0.325	
IC_{50}	50 mg / ml	

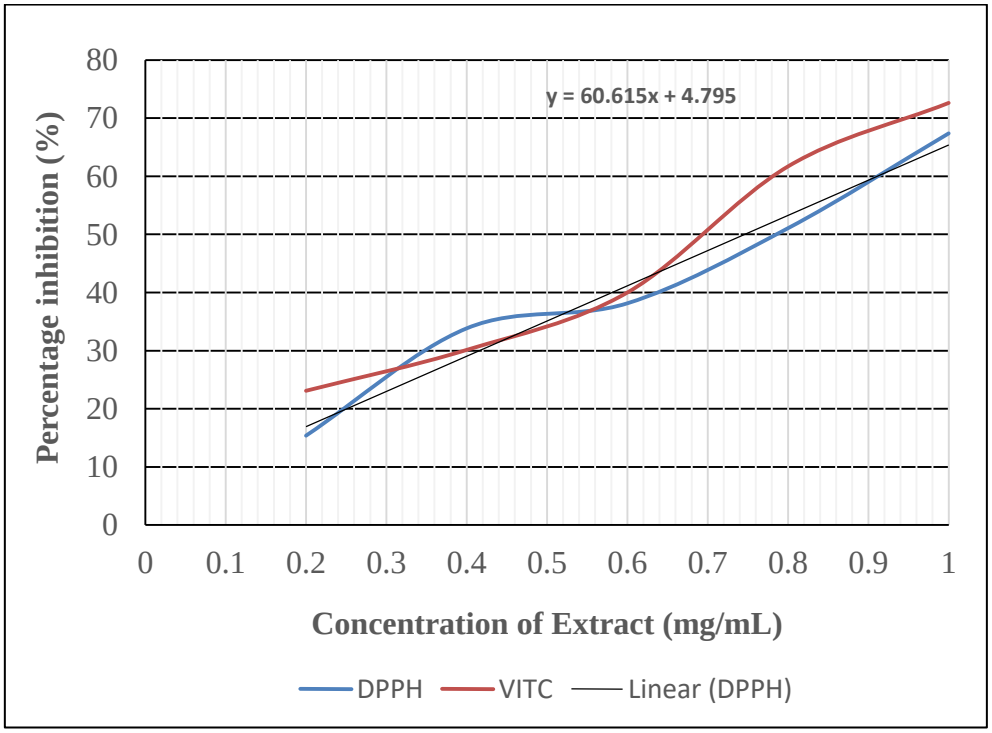

Figure 1. Comparative Analysis of Radical Scavenging Activity of Aqueous-methanol *S. ovata* Root Extract and Standard Vitamin C

The mean percentage of DPPH free-radical scavenging activity concentrations of extract is shown in Table 3. DPPH free-radical scavenging activity of the aqueous-methanol root extract of S. *ovata* competes favorably with those of standard vitamin C (Figure 1), hence, it could be suggested that root of *S. ovata* is a good natural remedy for reactive oxygen species responsible for oxidative stress. Findings of this study are consistent with those of [5].

Table 4. Frap (Ferric Reducing Antioxidant Power) Antioxidant Activity of Aqueous-methanol Extract of *S. ovata*

Concentration	Absorbance Test (AT)	I%
20mg	0.881	13.54
40mg	0.775	23.94
60mg	0.612	39.94
80mg	0.503	50.64
100mg	0.323	68.30
Absorbance control (AC)	1.019	
IC_{50}	50mg/ml	

The aqueous-methanol extract of *S. ovata* root demonstrated significant antioxidant activity, with FRAP values indicating a strong reducing power (Table 4). The results from FRAP assay agreed perfectly with those obtained from DPPH assay. Results from both assay presented the root extract of *S. ovata* to possess good antioxidant activities. Findings of the present study are similar to those of Alamgeer *et al.* [6].

3.5. Hypotensive Effect of Aqueous-methanol Extract of *S. ovata*

The results of the effect of aqueous methanol root extract on systolic blood pressure (SBP) of the experimental rats are presented in Table 5. The results showed clearly that SBP of the normative albino rats decreases progressively with increase of the extract dose. Administering 100 mg/kg of the extract to the experimental rats led to 5.4 % reduction of their SBP. Similar trend was observed for the various doses examined. ANOVA results (Table 5, column III) showed a significant difference ($P<0.05$) between the SBP of the normal rats and those treated with various doses of *S. ovata* extract. This implies that *S. ovata* extract has the ability of reducing the SBP of a normal rat, hence possesses hypotensive effect.

Table 5. Effect of Aqueous-methanol Extract of *S. ovata* on Systolic Blood Pressure of Normotensive Albino Rats

Treatment	Systolic Blood Pressure	ANOVA RESULTS p-value (Multiple Comparisons)				
		Normal	100 mg/kg	200 mg/kg	400 mg/kg	800 mg/kg
Normal (control)	120.75±0.75000	-	0.001	0.000	0.000	0.000
100 mg/kg	114.25±1.01868	0.001	-	0.517	0.002	0.001
200 mg/kg	113.25±0.62915	0.000	0.517	-	0.007	0.005
400 mg/kg	108.50±1.84842	0.000	0.002	0.002	-	0.870
800 mg/kg	108.25±0.25000	0.000	0.001	0.001	0.870	-

The effect of various doses of *S. ovata* extract on SBP of the albino rats were compared using multiple comparison (Table 5, Columns IV–VII). The result showed that there was no significant difference ($P>0.05$) between the effect of 100 and 200 mg/kg doses. This implies that both doses have similar effect on the SBP of the albino rats. Similar result was also demonstrated for the 400 and 800 mg/kg doses. However, there were significant differences ($P<0.05$) between the effect of 100 and 400 mg/kg as well as 100 and 800 mg/kg doses respectively. Similar trends

were observed 200 and 400 as well as 200 and 800 mg/mg doses. Findings of the present study is in congruence with results obtained for *Ficus carica* fruit [6].

Table 6. Effect of Aqueous-methanol Extract of *S. ovata* on Diastolic Blood Pressure of Normotensive Albino Rats

Treatment	**Diastolic Blood Pressure**	**ANOVA RESULTS**				
		p-value (Multiple Comparisons)				
		Normal	**100 mg/kg**	**200 mg/kg**	**400 mg/kg**	**800 mg/kg**
Normal (control)	80.50±0.5000	-	0.002	0.000	0.000	0.000
100 mg/kg	76.75±1.2500	0.002	-	0.459	0.003	0.000
200 mg/kg	76.0±0.7071	0.000	0.459	-	0.014	0.002
400 mg/kg	73.25±0.2500	0.000	0.003	0.014	-	0.327
800 mg/kg	72.25±0.2500	0.000	0.000	0.002	0.327	-

The result of effect of *S. ovata* root extract on diastolic blood pressure (DBP) of normotensive albino rats are shown in Table 6. The result indicated a reduction in the DBP of the experimental albino rats as they were administered various dosses of the aqueous methanol extract of *S. ovata.* Approximately 4.7 % decrease in DBP was observed by the administration of 100 mg/kg *S. ovata* extract. Progressively, administration of 200, 400 and 800 mg/kg aqueous-methanol extract of *S. ovata* (Table 6 column II), resulted in the reduction of their DBP by 5.6 %, 9.0% and 10.3 % respectively. This observation was attributed to increase in the concentration of the active ingredients in the higher doses. The findings indicated a dose dependent effect, as the highest dose examined (800 mg/kg) had over 10 % hypotensive effect on the DBP of the normotensive albino rats.

ANOVA results (Table 6 column III) showed that there was a significant difference ($P<0.05$) between the DBP of the normal albino rats (control) and the ones treated with various doses of *S. ovata* extract. However, from Table 6 column IV, increasing the dose of *S. ovata* extract from 100 mg/kg to 200 mg/kg, no significant difference ($P>0.05$) was observed in the DBP of the experimental albino rats. Interestingly, a highly significant difference ($P<0.05$) was recorded by further increasing the extract dose from 100 mg/kg to 400 mg/kg and 800 mg/kg. There was also appreciable significant difference ($P<0.05$) between 200, 400 and 800 mg/kg doses. As observed in Table 6, there was no significant difference between 400 and 800 mg/kg doses. Similar findings have been reported [11] that aporphine alkaloids possess transient hypotensive effect in rats. It could therefore be suggested that the hypotensive effect displayed by *S. ovata* extract on the experimental albino rats could be attributed to the presence of alkaloids and other secondary metabolites in the plant.

Table 7. Effect of Aqueous-Methanol Extract of *S. ovata* on Pulse Pressure of Normotensive Albino Rats

Treatment	**Pulse Pressure**	**ANOVA RESULTS**				
		p-value (Multiple Comparisons)				
		Normal	**100 mg/kg**	**200 mg/kg**	**400 mg/kg**	**800 mg/kg**
Normal (control)	40.25±0.2500	-	0.030	0.019	0.001	0.002
100 mg/kg	37.50±0.2887	0.030	-	0.830	0.068	0.209

200 mg/kg	37.25±0.2500	0.019	0.830	-	0.101	0.292
400 mg/kg	36.00±1.7500	0.001	0.068	0.101	-	0.522
800 mg/kg	35.25±0.0253	0.002	0.209	0.292	0.522	-

The effect of aqueous-methanol root extract of *S. ovata* on pulse pressure (PP) of the experimental rats is shown in Table 7. The results showed that PP of the normotensive albino rats decreased by approximately 6.8 % on administration of 100 mg/kg of the extract. There was a significant difference ($P<0.05$) between the PP of the untreated rat with the ones given 100 mg/kg of extract. However, the effect of increasing the concentrations of the extract beyond 100 mg/kg did not produce significant changes in the PP of the test rats. This implies that 100 mg/kg of aqueous-methanol extract of *S. ovata* was sufficient to considerably reduce the PP of normal albino rat. The results obtained in this study are similar to those reported elsewhere [20].

The result of effect of *S. ovata* root extract on mean arterial blood pressure (MABP) of normotensive albino rats are presented in Table 8. There was approximately 5.0 % reduction in MABP when 100 mg/kg *S. ovata* extract was administered. The result indicated a progressive reduction in the MABP of the experimental albino rats as they were administered various dosses of the aqueous-methanol extract of *S. ovata.* The findings indicated a dose dependent effect, as the highest dose (800 mg/kg) administered had approximately 10.3 % hypotensive effect on the MABP of the normotensive albino rats.

Table 8. Effect of Aqueous-methanol Extract of *S. ovata* on the Mean Arterial Blood Pressure of Normotensive Albino Rats

Treatment	**Mean Arterial Blood Pressure**	**ANOVA RESULTS**				
		p-value (Multiple Comparisons)				
		Normal	**100 mg/kg**	**200 mg/kg**	**400 mg/kg**	**800 mg/kg**
Normal (control)	93.92±0.5835	-	0.000	0.000	0.000	0.000
100 mg/kg	89.25±1.1970	0.000	-	0.442	0.001	0.000
200 mg/kg	88.42±0.6718	0.000	0.442	-	0.006	0.001
400 mg/kg	85.05±0.7071	0.000	0.001	0.006	-	0.488
800 mg/kg	84.25±0.2500	0.000	0.000	0.001	0.488	-

ANOVA results (Table 8 column III) showed that there was a significant difference ($P<0.05$) between the MABP of the normal albino rats (control) and the ones treated with various doses of *S. ovata* extract. However, from Table 8 column IV, increasing the dose of *S. ovata* extract from 100 mg/kg to 200 mg/kg, no significant difference ($P>0.05$) was observed in the MABP of the experimental albino rats. Interestingly, a highly significant difference ($P<0.05$) was recorded by further increasing the extract dose from 100 mg/kg to 400 mg/kg and 800 mg/kg. Findings of the present study corroborates similar study reported earlier [6].

4. Conclusion

The present study demonstrated that aqueous-methanol extract of *S. ovata* root is a rich source of phytochemicals, particularly flavonoids and phenolic compounds, which contributed to its potent antioxidant properties. The study

also demonstrated that aqueous-methanol extract of *S. ovata* root has hypotensive effect on normotensive albino rats, as low concentration of the extract (100 mg/kg) produced a significant decrease in systolic blood pressure, diastolic blood pressure, pulse pressure as well as mean arterial blood pressure by 5.4 %, 4.7 %, 6.8 % and 5.0 % respectively. These findings suggest that *S. ovata* is a promising plant for the development of natural antioxidant-based products. Based on the findings of the present study, it is suggested that further studies should be undertaken to isolate and characterize the specific bioactive component of *S. ovata* responsible for its high antioxidant activity. *S. ovata* is a choice herb for treating/managing several ailments amongst traditional medicine practitioners, hence, it is highly suggested that a holistic study should be carried out to elucidate the various therapeutic active ingredients of *S. ovata*.

Interestingly, the study established that *S. ovata* has the capacity to lower blood pressure of normotensive rats, it is therefore suggested that its antihypertensive activity should be investigated. Additionally, it is worthy of note that the present study is limited to the roots of *S. ovata*, therefore, embarking on a study using the whole plant is crucial, to harness its full potentials.

Declaration

Source of Funding

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Competing Interests Statement

The authors declare no competing financial, professional or personal interests.

Consent for publication

The authors declare that they consented to the publication of this study.

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