ORIGINAL ARTICLE

In vivo anti-typhoid evaluation of aqueous leaf-extract of *Olax subscorpioidea* on hematological and biochemical parameters in *salmonella typhi*-infected rats.

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ABSTRACT

Background: Typhoid fever is a global health concern, especially in Africa. Ongoing efforts seek effective plant-based treatments, with Olax subscorpioidea showing promise due to its traditional medicinal applications. Objective: This study investigated the therapeutic effects of the aqueous leaf extract of *Olax subscorpioidea* on biochemical and hematological parameters in *Salmonella typhi*-infected albino rats. Methods: A total of 92 albino rats were randomly assigned into groups (A–G). Groups A and B consisted of 16 rats each, while groups C to G had 12 rats each. Typhoid fever was induced in groups B to F through oral administration of 0.5 ml of *S. typhi* suspension containing 1×10^6 CFU/ml. Group A served as the normal control (uninfected, untreated), and group B as the negative control (infected, untreated). Group C was treated with 10 mg/kg ciprofloxacin (positive control). Groups D to G received 125, 250, 500, and 1000 mg/kg body weight of *O. subscorpioidea* aqueous extract, respectively. Infection was confirmed using the Widal agglutination test 48 hours post-infection. On days 5, 10, and 15 post-treatment, four rats from each group were sacrificed for biochemical and hematological analysis. Results: The extract significantly reversed *S. typhi*-induced alterations in both biochemical and hematological parameters. Improvements were dose-dependent and comparable to those observed in ciprofloxacin-treated rats, suggesting a robust therapeutic effect. Conclusion: The aqueous leaf extract of *Olax subscorpioidea* significantly improved S. typhi-induced abnormalities in albino rats, highlighting its promise as a plant-based therapeutic option for managing typhoid fever.

Keywords: Typhoid fever, *Olax subscorpioidea*, *Salmonella typhi*, Biochemical parameters, Hematological parameters.

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1.0 INTRODUCTION

Typhoid fever that is caused by the pathogenic bacterium *Salmonella enterica* serotype *Typhi,* continues to pose a significant and formidable health challenge globally, with particular severity observed in developing nations where the burden of disease is disproportionately high (1). It has been projected that there are nearly 16 million instances of typhoid fever and over 600,000 deaths linked to this disease annually, establishing it as a significant contributor to both illness and mortality, particularly in Southeast Asia and sub-Saharan Africa (2). Despite the accessibility of various antibiotics, such as quinolones and third-generation cephalosporins, the alarming increase in resistance exhibited by *Salmonella* strains towards these pharmacological interventions represents a growing challenge to the efficacy of treatment protocols (3). This rising tide of antibiotic resistance emphasizes the pressing necessity for the exploration and development of alternative therapeutic strategies, particularly those that are rooted in traditional herbal remedies and practices.

In light of this context, the exploration of plant-derived therapies has aroused the interests of researchers, particularly those that focus on the bioactive compounds inherent in these plants, which could provide safer and more economically viable alternatives to conventional synthetic pharmaceuticals. One noteworthy example of such a plant is *Olax subscorpioidea*, which belongs to the *Olacaceae* family and has exhibited a plethora of medicinal properties, encompassing notable antimicrobial and anti-inflammatory effects (4). Historically, the leaves and extracts of *O. subscorpioidea* have been employed within Nigerian traditional medicine for the treatment of an array of ailments, including but not limited to venereal diseases, arthritis, and asthma (4). Furthermore, recent investigative studies have drawn attention to the leaf-extract's membrane-stabilizing and antimicrobial characteristics, particularly as they manifest in both ethanolic and aqueous extracts (5,6). Nevertheless, there exists a notable scarcity of scientific inquiry that systematically examines the effects of the aqueous leaf extract of *O. subscorpioidea* on the hematological and biochemical parameters in organisms infected with *Salmonella typhi*, specifically in the widely utilized Wistar albino rat model, which is a staple in biomedical research.

The primary objective of this study is to address this existing gap by meticulously assessing the impact that the aqueous leaf extract of *Olax subscorpioidea* exerts on both hematological and biochemical parameters in Wistar albino rats that have been infected with *Salmonella typhi*. Through the evaluation of these specific parameters, this study endeavors to contribute significant and valuable insights into the potential therapeutic applications of *O. subscorpioidea* in the fight against typhoid fever, particularly in light of the concerning rise in antibiotic resistance observed in contemporary clinical settings. The findings derived from this investigation could yield critical data that may facilitate the development of innovative, plant-based treatments for typhoid fever, a disease that continues to exert considerable strain on public health systems on a global scale.

2.0 MATERIALS AND METHODS

2.1 Materials

2.1.1 Equipment/Instruments

The main equipment used in this study are as follows: spectrophotometer (SPM 721, 2000 bio-trust diagnostics, USA), digital colorimeter, India, rotary evaporator (model 349/2, corning Ltd, England), refrigerator (haier thermocool, England), counting chamber (MC Qiujing, China) and Kjeldahl distillation apparatus (pyrex, England).

2.1.2 Chemicals and reagents

All chemicals and reagents used were of analytical standard.

2.2 Methods

2.2.1 Ethical approval statement

The research followed internationally accepted guidelines for the care and handling of lab animals. As the representative of the core Institutional Ethics Review Committee of Ebonyi State University, the Department of Biochemistry Research Ethics Committees approved our ethical request and issued us the license number/code EBSU/BCH/ET/22/010

2.2.2 Procurement of plant material

Fresh leaves of *Olax subscorpioidea* were used as the plant material for this study. They were collected from Ndegu-Ngbo, located in Ohaukwu Local Government Area of Ebonyi State, Nigeria. The plant was subsequently identified by Professor S. C. Onyekwelu, a plant taxonomist in the Department of Applied Biology at Ebonyi State University, Abakaliki, Ebonyi State.

2.2.3 Procurement of laboratory animals

Albino Wistar rats were procured from the Department of Veterinary Medicine, University

of Nigeria, Nsukka, Nigeria. The animals were housed in the animal facility of Divine Chemical and Analytical Laboratory, Nsukka, where they were acclimatized for seven (7) days prior to commencement of treatment. They were maintained under standard laboratory conditions in well-ventilated wooden and wire-mesh cages measuring approximately 60 cm × 40 cm × 20 cm. The housing environment was kept clean, with wood-shaving bedding changed regularly. The rats were kept at room temperature (25 ± 2 °C) under a 12-hour light/12-hour dark cycle and were provided with standard commercial pellet feed and clean drinking water ad libitum.

2.2.4 Extraction of Leaves of *Olax subscorpioidea*

The extraction of *Olax subscorpioidea* leaves was carried out using the cold aqueous maceration method, a conventional solvent extraction technique widely employed for isolating thermolabile bioactive compounds from plant materials (Harborne, 1998; Sofowora, 2008).

Fresh leaves of *Olax subscorpioidea* were washed thoroughly under running tap water to remove adhering debris and contaminants. The leaves were air-dried under shade at room temperature until a constant crispy texture was obtained in order to prevent photodegradation and loss of volatile constituents. The dried leaves were pulverized into a fine powder using a blending machine previously rinsed with absolute ethanol to avoid cross-contamination.

Five hundred grams (500 g) of the powdered plant material were soaked in 1000 mL of distilled water for 48 hours at room temperature with intermittent agitation to enhance solvent penetration and extraction efficiency. The resulting mixture was filtered using a clean white muslin cloth followed by Whatman No. 1 filter paper to obtain a clear filtrate.

The filtrate was concentrated using a rotary evaporator at 30 °C for 10 minutes under reduced pressure to obtain the crude aqueous extract. The extract was further air-dried to remove residual moisture and stored in sterile airtight containers at 4 °C until required for in vivo analysis.

Chemical (Phytochemical) Characterization

Plant material was chemically characterized. Preliminary phytochemical screening of the aqueous leaf extract of *Olax subscorpioidea* was conducted using standard qualitative methods to determine the presence of major bioactive constituents, including alkaloids, flavonoids, tannins, saponins, phenolics, terpenoids, and glycosides, following established protocols (Trease & Evans, 2009; Sofowora, 2008).

2.2.5 Experimental design

In this study, 92 male albino rats were used and randomly assigned to seven experimental groups (A to G). Group A (16 rats) was the normal control group, receiving standard animal food and water only. Group B (16 rats) was the negative control group, consisting of typhoid-infected rats with no treatment. Group C (12 rats) was the positive control group, where typhoid-infected rats were treated with 10 mg/kg of ciprofloxacin, an antibiotic(7). Groups D, E, F, and G (12 rats each) included typhoid-infected rats treated with different doses of *Olax subscorpioidea* leaf extract (125, 250, 500, and 1000 mg/kg body weight, respectively) (8). All treatments were given once daily for 15 days.

Following the induction and confirmation of typhoid fever, a single subgroup of four rats from both Groups A and B was sacrificed for *In-vivo* analysis. Additional subgroups, consisting of four rats from each of the remaining groups, were sacrificed on the 5th, 10th, and 15th days of treatment for further *In-vivo* studies.

2.2.6 Induction and confirmation of typhoid antibody

About 0.5 ml of *Salmonella typhi* at a dose of 1 x10^6 CFU/ml was orally administered to the rats to induce typhoid fever (9). Widal agglutination test was used to confirm the presence of typhoid antibody in the induced rats.

2.2.7 *In-vivo* Biochemical and Hematological Analyses

2.2.7.1 Determination of serum lipid profiles

The method described by (10) was used to measure the serum triacylglycerol concentration. Total cholesterol was assessed using the method of (11). To calculate low-density lipoprotein (LDL) cholesterol, the total cholesterol value was subtracted by the values for triacylglycerol and high-density lipoprotein (HDL) cholesterol, as shown below:

LDL = Total Cholesterol - Triacylglycerol - HDL Cholesterol (in mg/dl)

The HDL cholesterol fraction was determined based on Allain's method (1974).

2.2.7.2 Determination of liver function indices
The activity of ALT and AST in blood serum were measured using the procedure developed (12). Alkaline phosphate levels were determined using the method described by (13).

2.2.7.3 Determination of hematological parameters
An improved Neubauer's counting chamber was used to count red blood cells (RBCs) (14). Hemoglobin (Hb) concentration was measured using the cyanmethemoglobin method (15). Packed cell volume (PCV) was determined using the microhematocrit method (Bull et al., 2001). Leukocyte (white blood cell) count was performed using a Neubauer hemocytometer (14).

RESULTS

3.1 Impact of Aqueous Leaf Extract of *Olax subscorpioidea* on the Lipid Profile of Albino Rats Infected with *Salmonella typhi*
A significant (P<0.05) decrease in high density lipoprotein (HDL) in group B (S*almonella typhi* induced only) were shown while standard drug and varied doses of *Olax subscorpioidea* increased significantly (P <0.05). Total cholesterol (TC), triaglycerides (TG) and low-density lipoprotein (LDL) in group B (*Salmonella typhi* induced only) increased significantly (P < 0.05) while on treatment with varied doses of *Olax subscorpioidea* decreased significantly (P < 0.05) as shown in Table 1.

3.2. Impact of Aqueous Leaf Extract of *Olax subscorpioidea* on AST, ALT, ALP, Albumin, and Bilirubin Levels in Albino Rats Infected with *Salmonella typhi*.
The effects of *Olax subscorpioidea* leaf extract on liver function indices in *Salmonella typhi*-infected albino rats are shown in Table 2. The results revealed that, when compared to the positive control, the negative control group had significantly (P<0.05) higher levels of ALT, AST, ALP activity, and bilirubin, along with significantly (P<0.05) lower albumin levels in all the four periods. However, when the infected rats were treated with varying doses of *Olax subscorpioidea* leaf extract (125, 250, 500, and 1000 mg/kg body weight), there was a significant (P<0.05) decrease in AST, ALT, ALP activities, and bilirubin levels. In contrast, albumin concentration significantly (P<0.05) increased.

3.3. Impact of Aqueous Leaf Extract of *Olax subscorpioidea* on Hematological Indices in Albino Rats Infected with *Salmonella typhi*
The results showed a significant (P<0.05) decrease in red blood cell count and hemoglobin level with significant (P<0.05) reduction in white blood cell concentration in the group that was induced with *Salmonella typhi* without treatment (negative control) relative to the positive control. But for the groups that were treated with varied doses of *Olax subscorpioidea* leaf extract and standard drug revealed a significant (P<0.05) increase in the levels of these haematological parameters relative to the negative control as shown in Tables 3a and 3b.

DISCUSSION
Table 1 of this study highlights the intricate relationship between lipid metabolism and bacterial infections, particularly focusing on *Salmonella typhi*. The observed reduction in high-density lipoprotein cholesterol (HDL-c) levels in the *Salmonella*-infected group supports existing research output linking *Salmonella typhi* infections to altered lipid profiles (16). Since HDL-c plays a crucial role in protecting against cardiovascular diseases, especially atherosclerosis (17), its observed reduction in the infected rat group is particularly concerning. However, the study found that administering *Olax subscorpioidea* significantly (P<0.05) increased HDL-c levels, suggesting that the leaf-extract may help reverse these harmful effects. This is consistent with prior studies that emphasize the anti-inflammatory properties of bioactive compounds in *Olax subscorpioidea*, which could help restore lipid balance by improving lipid transport functions (18)

Furthermore, this study also sheds light on *Olax subscorpioidea's* broader role in lipid metabolism, particularly its ability to counteract the increase in total cholesterol (TC), triglycerides (TG), and low-density lipoprotein (LDL) levels associated with *Salmonella typhi* infection. This dyslipidemia, characterized by elevated levels of atherogenic lipids, has been linked to atherosclerosis and stroke (19). The significant reduction in these atherogenic lipids after *Olax subscorpioidea* treatment suggests that it may act as a lipid-lowering therapy. These results not only support the potential of *Olax subscorpioidea* in regulating lipid profiles in during typhoid infections but also highlight its broader therapeutic potential interventions to improve lipid metabolism by reducing inflammation and oxidative stress (18,20)

Results of table 2 of this study further suggests that *Olax subscorpioidea* could offer hepatoprotective benefits in

Salmonella typhi-infected albino rats. The negative control group showed a significant ($P<0.05$) increase in liver enzyme biomarkers (ALT, AST, ALP) and bilirubin, alongside a decrease in albumin levels, which typically indicates liver damage. Elevated liver enzymes signal hepatocellular injury and impaired liver function (21). However, administering aqueous *Olax subscorpioidea* leaf extract at various doses led to a notable decrease in these biomarkers, indicating the *Olax subscorpioidea's* potential to mitigate liver injury induced by *Salmonella typhi* infection. The reduction in liver enzyme activity and bilirubin levels, along with an increase in albumin, supports the idea that the extract may help restore liver function by counteracting oxidative stress or inflammation caused by the infection (18,20)

Moreso, Table 2 results also suggests that the hepatoprotective effects of *Olax subscorpioidea* may be dose-dependent. Higher doses of the leaf extract led to greater improvements in liver function, which may be due to the bioactive compounds in the plant interacting with liver cells to enhance detoxification and recovery processes. This aligns with previous studies on herbal extracts, which have demonstrated that plant bioactive compounds possess significant antioxidant and anti-inflammatory properties that can protect against liver damage (22). These results point to the need for further research to better understand the pharmacological mechanisms of *Olax subscorpioidea,* which could pave the way for novel, plant-based therapies for liver dysfunction caused by infectious diseases.

Results presented in table 3a and 3b of this present study highlight the impact of *Olax subscorpioidea* leaf extract on haematological parameters in *Salmonella typhi*-infected albino rats, showing a dose-dependent improvement in red and white blood cell counts, hemoglobin levels, and packed cell volume (PCV). The negative control group exhibited significant reductions in red blood cell count, hemoglobin, and white blood cell concentration, confirming the detrimental effects of *Salmonella typhi* infection on these parameters. In contrast, rats treated with various doses of *Olax subscorpioide*a leaf extract showed a significant recovery, with results approaching those seen in the positive control group (treated with a standard drug). The data presented in Tables 3a and 3b demonstrate that the extract's effects were both dose- and time-dependent, with higher doses leading to better results over a 15-day period. This suggests that *Olax subscorpioidea* could be a promising therapeutic option for alleviating haematological abnormalities caused by *Salmonella typhi* infection.
Furthermore, these findings suggest that *Olax subscorpioidea* may serve as an alternative or complementary treatment for *Salmonella typhi* infection infections that cause haematological changes, offering a natural remedy with fewer side effects compared to conventional drugs. The significant improvements observed across different dosages and time intervals highlight the leaf-extract's potential in boosting immune response and red blood cell production, which could be crucial for recovery in infected subjects. However, while the study presents promising evidence for *Olax subscorpioidea's* efficacy, further research is necessary to isolate the active compounds responsible for these effects and to evaluate their safety and efficacy in human clinical trials. Such studies could lead to the development of new therapy for *Salmonella typhi* infections or other conditions that affect blood parameters.

Conclusion

In conclusion, the present study underscores the potential of *Olax subscorpioidea* as a promising therapeutic agent for managing the metabolic, hepatoprotective, and haematological disruptions caused by *Salmonella typhi* infection. By restoring healthy lipid profiles, mitigating liver damage, and improving haematological parameters, the leaf-extract shows significant promise in counteracting the harmful effects of *Salmonella typhi* infections. Its dose-dependent efficacy further supports its therapeutic potential, with improvements observed in both lipid metabolism and liver function. While these findings are compelling, they also highlight the need for further investigation into the specific bioactive compounds responsible for these benefits and their safety and efficacy in human clinical trials. This research opens the door to developing innovative, plant-based treatments that could complement or even replace conventional therapies, offering a natural approach to combat infection-induced metabolic disturbances with minimal side effects.

REFERENCE

1) Ashurst JV, Truong J, Woodbury B. Typhoid Fever (Salmonella Typhi) (Archived). In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 [cited 2025 Mar 10]. Available from: http://www.ncbi.nlm.nih.gov/books/NBK519002/
2) Kim CL, Cruz Espinoza LM, Vannice KS, Tadesse BT, Owusu-Dabo E, Rakotozandrindrainy R, et al. The Burden of Typhoid Fever in Sub-Saharan Africa: A Perspective. Res Rep Trop Med. 2022;13:1–9.

3) Tang K, Zhao H. Quinolone Antibiotics: Resistance and Therapy. Infect Drug Resist. 2023 Feb 10;16:811–20.
4) Ahmad MH, Jatau AI, Alshargi OY, Julde SM, Mohammed M, Muhammad S, et al. Ethnopharmacological uses, phytochemistry, pharmacology, and toxicology of Olax subscorpioidea Oliv (Olacaceae): a review. Future J Pharm Sci. 2021 Jun 5;7(1):115.
5) Bastías DA, Balestrini R, Pollmann S, Gundel PE. Environmental interference of plant−microbe interactions. Plant Cell Environ. 2022;45(12):3387–98.
6) Glick BR, Gamalero E. Recent Developments in the Study of Plant Microbiomes. Microorganisms. 2021 Jul;9(7):1533.
7) Alandiyjany MN, Abdelaziz AS, Abdelfattah-Hassan A, Hegazy WAH, Hassan AA, Elazab ST, et al. Novel In Vivo Assessment of Antimicrobial Efficacy of Ciprofloxacin Loaded Mesoporous Silica Nanoparticles against Salmonella typhimurium Infection. Pharmaceuticals. 2022 Mar 15;15(3):357.
8) Adeoluwa OA, Aderibigbe AO, Agu GO. Pharmacological Evaluation of Central Nervous System Effects of Ethanol Leaf Extract of Olax Subscorpioidea in Experimental Animals. Drug Res. 2016 Apr;66(4):203–10.
9) Muhammad HL, Garba R, Abdullah AS, Muhammad HK, Busari MB, Hamzah RU, et al. *In vivo* anti-typhoid and safety evaluation of extracts of *Ximenia americana* on experimental rats. Pharmacol Res - Mod Chin Med. 2021 Dec 1;1:100009.
10) Tietz NW. Clinical guide to laboratory tests. 2nd ed. Philadelphia: Saunders; 1990. xxiv, 931 p.
11) Allain CC, Poon LS, Chan CS, Richmond W, Fu PC. Enzymatic determination of total serum cholesterol. Clin Chem. 1974 Apr;20(4):470–5.
12) Reitman S, Frankel S. A colorimetric method for the determination of serum glutamic oxalacetic and glutamic pyruvic transaminases. Am J Clin Pathol. 1957 Jul;28(1):56–63.
13) Hartree EF. Determination of protein: a modification of the Lowry method that gives a linear photometric response. Anal Biochem. 1972 Aug;48(2):422–7.
14) Zhang M, Gu L, Zheng P, Chen Z, Dou X, Qin Q, et al. Improvement of cell counting method for Neubauer counting chamber. J Clin Lab Anal. 2019 Aug 30;34(1):e23024.
15) Ranganathan H, Gunasekaran N. Simple method for estimation of hemoglobin in human blood using color analysis. IEEE Trans Inf Technol Biomed Publ IEEE Eng Med Biol Soc. 2006 Oct;10(4):657–62.
16) Natesan V, Kim SJ. Lipid Metabolism, Disorders and Therapeutic Drugs – Review. Biomol Ther. 2021 Nov 1;29(6):596–604.
17) Kosmas CE, Martinez I, Sourlas A, Bouza KV, Campos FN, Torres V, et al. High-density lipoprotein (HDL) functionality and its relevance to atherosclerotic cardiovascular disease. Drugs Context. 2018 Mar 28;7:212525.
18) Saleh HA, Yousef MH, Abdelnaser A. The Anti-Inflammatory Properties of Phytochemicals and Their Effects on Epigenetic Mechanisms Involved in TLR4/NF-κB-Mediated Inflammation. Front Immunol. 2021;12:606069.
19) Manjunath CN, Rawal JR, Irani PM, Madhu K. Atherogenic dyslipidemia. Indian J Endocrinol Metab. 2013;17(6):969–76.
20) Adeniyi IA, Oregbesan PO, Adesanya A, Olubori MA, Olayinka GS, Ajayi AM, et al. *Olax subscorpioidea* prevented scopolamine-induced memory impairment through the prevention of oxido-inflammatory damage and modulation of cholinergic transmission. J Ethnopharmacol. 2024 Jan 10;318:116995.
21) Kalas MA, Chavez L, Leon M, Taweesedt PT, Surani S. Abnormal liver enzymes: A review for clinicians. World J Hepatol. 2021 Nov 27;13(11):1688–98.
22) Parham S, Kharazi AZ, Bakhsheshi-Rad HR, Nur H, Ismail AF, Sharif S, et al. Antioxidant, Antimicrobial and Antiviral Properties of Herbal Materials. Antioxidants. 2020 Dec 21;9(12):1309.

Table 1: Impact of Aqueous Leaf Extract of *Olax subscorpioidea* on the Lipid Profile of Albino Rats Infected with *Salmonella typhi*.

Period	TC(mg/dl)	TG(mg/dl)	HDL- c(mg/dl)	LDL-c (mg/dl)
48Hrs				
A	221.30±2.15^{a}	204.22±3.93^{a}	163.30±2.91^{a}	17.18±0.35^{a}
B	250.76±2.62^{b}	251.44±0.90^{b}	108.61±2.11^{b}	88.26±2.71^{b}
5Th Day				
A	222.14±3.44^{a}	204.69±3.28^{a}	161.76±4.39^{a}	16.11±1.83^{a}
B	272.69±4.44^{c}	253.44±5.02^{b}	102.26±2.35^{b}	113.24±11.72^{c}
C	213.02±6.81^{d}	210.49±7.85^{c}	137.61±4.99^{c}	26.80±2.15^{d}
D	232.17±1.94^{e}	235.23±3.04^{d}	126.44±5.47^{d}	58.49±3.87^{e}
E	222.16±4.27^{a}	212.52±7.06^{c}	129.62±1.89^{de}	50.03±6.17^{f}
F	220.69±3.37^{a}	206.95±4.23^{a}	133.99±4.87^{e}	45.31±4.35^{g}
G	211.40±5.24^{d}	205.11±3.53^{a}	141.77±2.97^{f}	28.61±6.72^{d}
10th Day				
A	224.68±1.19^{a}	197.29±0.87^{e}	165.40±1.03^{a}	19.83±2.11^{h}
B	275.67±18.69^{c}	265.86±3.37^{f}	109.00±0.44^{b}	103.66±17.71^{i}
C	217.01±1.55^{f}	206.51±4.47^{a}	147.78±4.00^{g}	27.93±5.67^{d}
D	224.99±4.66^{a}	212.19±2.26^{c}	125.84±5.33^{d}	53.38±4.04^{e}
E	219.11±2.38^{af}	209.73±1.47^{ac}	138.18±3.48^{c}	38.89±4.99^{f}
F	216.08±0.67^{f}	202.82±0.97^{a}	145.59±2.52^{h}	29.93±3.27^{d}
G	217.83±4.19^{f}	199.51±1.51^{a}	155.39±3.58^{i}	22.54±6.65^{k}
15th Day				
A	220.49±2.75^{a}	210.04±1.92^{c}	165.44±1.88^{a}	13.05±4.78^{a}
B	275.75±6.04^{c}	271.76±3.58^{g}	111.05±3.11^{j}	110.14±6.75^{c}
C	219.26±2.01^{af}	217.04±1.32^{ch}	159.16±7.41^{k}	16.69±8.36^{h}
D	229.28±2.24^{g}	220.50±1.77^{h}	142.88±1.56^{f}	42.30±4.06^{f}
E	218.83±0.72^{af}	219.61±2.63^{h}	146.83±3.06^{g}	28.10±2.05^{d}
F	218.84±0.89^{af}	218.08±0.57^{h}	153.77±2.37^{i}	21.45±2.33^{k}
G	214.19±1.51^{d}	214.67±0.97^{ch}	161.65±2.53^{a}	9.60±1.09^{l}

Results are presented as mean ± S.D, mean values with (different superscript) have significant differences ($P<0.05$) when compared with the negative and the positive control. A = Normal control, B = Negative control, C = positive control, D = 125 mg/kg, E = 250 mg/kg, F = 500 mg/kgand G = 1000 mg/kg body weight. The numbers 48hrs, 5, 10 and 15 represent exposure periods.

Table 2: Impact of Aqueous Leaf Extract of *Olax subscorpioidea* on AST, ALT, ALP, Albumin, and Bilirubin Levels in Albino Rats Infected with *Salmonella typhi*

Period	ALT (IU/l)	AST (IU/l)	ALP (IU/l)	TB(mg/dl)	Alb(mg/dl)
48hrs					
A	76.67±1.25^{a}	40.67±1.15^{a}	81.37±2.45^{a}	0.65±0.05^{a}	1.72±0.08^{a}
B	156.67±2.08^{b}	84.67±4.16^{b}	143.91±2.94^{b}	0.81±0.09^{b}	1.12±0.09^{b}
5th Day					
A	75.00±4.58^{a}	40.33±2.45^{a}	81.67±4.06^{a}	0.63±0.06^{a}	1.69±0.08^{c}
B	158.00±5.00^{b}	84.67±3.21^{b}	148.15±3.78^{b}	0.88±0.05^{b}	1.15±0.08^{b}
C	90.67±6.43^{c}	39.33±2.65^{a}	88.15±4.34^{c}	0.80±0.04^{c}	1.53±0.06^{d}
D	133.67±4.51^{d}	62.33±1.53^{c}	114.80±3.55^{d}	0.70±0.04^{d}	1.39±0.08^{e}
E	110.67±1.53^{e}	56.67±1.53d	110.73±2.99^{d}	0.67±0.05^{ad}	1.44±0.07^{de}
F	97.67±1.53^{f}	52.33±1.53^{e}	96.00±2.00^{e}	0.64±0.03^{a}	1.49±0.07^{d}
G	92.33±1.53^{c}	46.00±2.00^{f}	90.33±2.08^{f}	0.61±0.02^{a}	1.49±0.04^{d}
10th Day					
A	78.67±1.53^{a}	40.00±1.00^{a}	80.55±1.68^{a}	0.64±0.05^{a}	1.67±0.06^{c}
B	143.67±2.08^{g}	81.67±1.53^{g}	142.78±1.99^{b}	0.89±0.03^{b}	1.08±0.05^{f}
C	84.67±1.53^{h}	41.00±1.73^{a}	86.24±1.32^{g}	0.78±0.03^{c}	1.48±0.09^{d}
D	113.33±5.13^{e}	58.67±2.08^{d}	106.14±3.01^{h}	0.71±0.05^{d}	1.32±0.07^{g}
E	99.67±8.33^{f}	45.00±3.00^{f}	88.03±4.75^{c}	0.71±0.05^{d}	1.38±0.04^{e}
F	96.00±2.65^{f}	45.00±3.00^{f}	88.03±3.32^{c}	0.68±0.03^{ad}	1.39±0.09^{e}
G	88.00±2.65^{c}	41.33±1.75^{a}	86.65±2.67^{g}	0.66±0.04^{ad}	1.49±0.10^{d}
15th Day					
A	76.00±1.73^{a}	53.00±4.45^{e}	83.84±3.74^{a}	0.64±0.03^{a}	1.77±0.07^{a}
B	148.67±2.08^{g}	87.67±2.67^{h}	146.38±2.36^{b}	0.84±0.05^{b}	0.90±0.06^{h}
C	80.67±1.53^{hi}	41.33±3.51^{a}	85.67±1.82^{g}	0.70±0.05^{d}	1.45±0.06^{de}
D	92.67±2.08^{c}	54.67±1.53^{i}	96.82±1.62^{e}	0.68±0.03^{ad}	1.39±0.06^{e}
E	83.67±1.58^{h}	51.00±2.65^{ei}	94.15±3.86^{e}	0.67±0.05^{ad}	1.49±0.06^{d}
F	82.33±3.56^{i}	45.67±2.08^{f}	88.89±3.56^{c}	0.65±0.03^{a}	1.56±0.09^{i}
G	79.33±1.53^{hi}	41.67±1.98^{a}	87.06±2.35^{c}	0.62±0.07^{e}	1.58±0.07^{i}

Results are presented as mean ± S.D, mean values with (different superscript) have significant differences ($P<0.05$) when compared with the negative and the positive control. A = Normal control, B = Negative control, C = positive control, D = 125 mg/kg, E = 250 mg/kg, F = 500 mg/kg and G = 1000 mg/kg body weight. The numbers 48hrs, 5th, 10thand 15th represent exposure periods.

Table 3a: Impact of Aqueous Leaf Extract of *Olax subscorpioidea* on Hematological Indices in Albino Rats Infected with *Salmonella typhi*.

Period	PCV(%)	WBC(X10^9)	RBC(X10^9)	Hb(g/dl)
48HRS				
A	56.33±2.08^a	7682.67±102.87^a	288.00±28.35^a	11.96±0.58^a
B	41.67±2.89^b	5406.00±95.02^b	223.33±15.28^b	8.22±0.47^b
5th Day				
A	57.67±1.53^a	7400.00±1039.23^a	281.33±14.01^a	12.36±0.45^a
B	41.33±0.58^b	5933.33±152.75^c	246.33±6.51^c	9.42±0.41^c
C	53.67±1.15^c	6533.33±251.66^d	254.33±12.10^d	10.96±0.67^d
D	48.33±3.21^d	6166.67±115.47^e	235.00±8.89^e	10.03±0.59^e
E	49.00±3.61^d	6233.33±57.74^e	228.67±11.85^b	10.29±0.49^f
F	49.00±2.65^d	6233.33±378.59^e	234.67±7.57^e	10.86±0.52^g
G	49.33±2.08^d	6633.33±378.59^d	249.00±5.29f	11.32±0.56^d
10th Day				
A	55.00±1.00^a	7066.67±152.75^f	292.00±6.00^a	12.01±0.85^a
B	41.67±1.53^b	6000.00±264.58^c	251.00±7.00^c	9.30±0.48^c
C	49.33±2.52^d	6733.33±611.01^d	252.67±30.04^c	10.36±0.42^h
D	44.67±1.53^e	6400.00±346.41^g	256.00±8.19^f	9.67±0.93^e
E	43.33±3.06^e	6433.33±230.94^g	259.67±7.37^f	10.16±0.44^f
F	44.33±1.53^e	6800.00±400.00^d	266.33±6.11^d	10.36±0.57^h
G	46.33±1.15^f	6933.33±152.75^f	271.33±2.52^g	10.81±0.39^g

Results are presented as mean ± S.D, mean values with (different superscript) have significant differences (P<0.05) when compared with the negative and the positive control. A = Normal control, B = Negative control, C = standard drug, D = 125 mg/kg, E = 250 mg/kg, F = 500 mg/kgand G = 1000 mg/kg body weight. The numbers 48hrs, 5, 10 and 15 represent exposure periods.

Table 3b: Impact of Aqueous Leaf Extract of *Olax subscorpioidea* on Hematological Indices in Albino Rats Infected with *Salmonella typhi*

Period	PCV(%)	WBC(X10^9)	RBC(X10^9)	Hb(g/dl)
15th Day				
A	56.33±1.53^a	7566.67±550/76^a	293.33±5.03^a	12.00±0.57^a
B	42.67±0.58^b	6066.67±251.66^c	250.00±6.00^h	8.99±0.33^b
C	50.00±1.00^d	6433.33±750.56^g	268.33±2.08^f	11.35±0.96^i
D	47.00±1.00^e	6066.67±152.75^c	252.33±4.83^h	9.82±0.43^e
E	47.00±1.00^f	6233.33±378.59^e	260.33±18.58^c	9.92±0.31^e
F	49.00±2.00^d	6400.00±435.89^g	261.33±14.22^c	10.05±0.58^f
G	51.00±1.00^e	6866.67±208.17^f	273.33±6.66^g	11.56±0.31^i

Results are presented as mean ± S.D, mean values with (different superscript) have significant differences (P<0.05) when compared with the negative and the positive control. A = Normal control, B = Negative control, C = standard drug, D = 125 mg/kg, E = 250 mg/kg, F = 500 mg/kg and G = 1000 mg/kg body weight. The numbers 48hrs, 5, 10 and 15 represent exposure periods.