Morphophysiological Changes in the Liver of Wistar Rats Exposed to Acute and Chronic Concentrations of *Vitellaria paradoxa*

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Received 29th April 2020; Revised 20th May 2020; Accepted 23rd May 2020

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Abstract

**Background:** *Vitellaria paradoxa* is a tropical plant with diverse folkloric health benefits that could be optimised in health product development. This study was therefore designed to investigate morphophysiological changes in the liver of rats exposed to acute and chronic concentrations of *Vitellaria paradoxa*

**Methods:** A total of seventy-four (74) animals (Wistar rats and mice) were randomly assigned into two main groups based on toxicity plan; acute group consist of 9 sub-groups [0 (control), 10, 20, 40, 80, 160, 320, 640 and 1280 mg/kg; n=6] while the chronic group consists of 4 sub-groups [0 (control), 32, 64 and 128 mg/kg; n=20] were orally exposed to *Vitellaria paradoxa*. The 96 hour LC₅₀ value of *Vitellaria paradoxa* was calculated as 640mg/kg body

**Results:** The acute concentrations of *Vitellaria paradoxa* induced dose-dependent severity in clinical signs such as: twitching, increase rate of respiration, sedation, abdominal muscle contractions and increased motor activity. The chronic concentrated grades of *Vitellaria paradoxa* more particularly the higher doses (64 and 128mg/kg) elicited significantly increased serum liver enzymes (ALT, ALP and AST) values compared to the control. Similarly, several hepatic histoarchitectural lesions such as: mild to severe, central venous and sinusoidal congestion, hepatic degeneration, and necrosis with loss of cord arrangement were strikingly visible at the higher doses. There was no significant difference in the haematological parameters across the different concentrations

**Conclusion:** This study has shown that *Vitellaria paradoxa* seems to be unsafe following a prolonged administration. Therefore, caution should be taken in its both short and long term usage

**Keywords:** Liver, hepatic enzymes, morphophysiological changes, haematology, *Vitellaria paradoxa*
1.0 INTRODUCTION

Vitellaria paradoxa (C.F. Gaertn) otherwise known as Butyrospermum paradoxum is a tropical plant originating from the wild of the dry savannah belt of West Africa [1]. It is naturally grown in the west of Africa, extended to the east and onto the foothills of the Ethiopian mountains [2]. It belongs to the family Sapotaceae which is divided into 53 genera and about 1250 species distributed worldwide [3]. The genus Vitellaria are monospecific, two subspecies are recognized; ssp. paradoxa and ssp. Nilotica, each of which is restricted to Western and Eastern Africa, respectively. Vitellaria paradoxa has many common names, depending on which country they are found. It is referred to as “lulu” in Arabic; “shea-butter tree” in English; “karité, arbre a beurre” in French and “tango” in Spanish, respectively. In Nigeria, Vitellaria paradoxa is widely distributed and in Yoruba language, it is locally named (Igi Emi); Hausa (kadanya) and Igbo (okwuma), respectively [3].

The plant is majorly cultivated for its industrial, economical and pharmaceutical benefits. The timber from the tree is of high use in house construction, engineering, ship and household utensils construction [3]. Shea butter oil obtained from the shea tree has both high economical and pharmaceutical values. It promotes wound healing and soothes skin irritation, also used to treat inflammation, rashes in children, dermatitis, chapping, cough, malaria and ulcers, as well as rub for rheumatism [4]. In addition, it is extensively used in the cosmetic industries as an ingredient for lipsticks, soaps, shampoo and skin cream preparations [5]. In folkloric medicine, Vitellaria paradoxa has been employed for treating several ailments [4, 6]. Decoctions from its leaf and root are used to treat myriads of health conditions including digestive disorders, headache, eye problems, jaundice, leprosy, chronic sores, convulsion and haemorrhoids, while, the bark infusions are used to ease childbirth and enhanced lactation after delivery or as a cobra venom neutralizer [7].

Despite the numerous health benefits from Vitellaria paradoxa tree, there is paucity of information on its toxicity profile. Hence, this study evaluated the safety of Vitellaria paradoxa ethanolic leaf extract in experimental animals following acute and prolonged exposure in order to provide guidelines for establishing suitable dose range on further health product development.

2.0 METHODOLOGY

2.1 Plant Material Collection and Authentication

Fresh leaves of Vitellaria paradoxa were obtained from Kajola village, Ejigbo, Osun State, Osogbo, Nigeria. They were identified and authenticated in the Herbarium of the Department of Botany, Obafemi Awolowo University, Ile Ife, with voucher specimen number IFE-16744

2.2 Plant Extract Preparation

Ethanolic leaf extract of Vitellaria paradoxa was prepared using the method of Omirinde et al.[8]. Briefly, Vitellaria paradoxa leaves were air-dried and pulverised into powder. Powdered leaves were then decocted and refluxed three times with ethanol at room temperature. The filtrate was concentrated by rotary vacuum evaporation and then lyophilized with a freeze dryer. The lyophilized powder was scraped into a cleaned universal bottle and refrigerated until it was used.

2.3 Animals and Ethical Considerations

Twenty (20) Wistar rats, 150-180 grams and fifty-four (54) mice, 20-25g of either sex were obtained from the Animal House of Ladoke Akintola University of Technology, Mercyland Campus, Oshogbo. The experimental animals were kept and maintained in a temperature-controlled environment (25 ± 2°C) with a 12hr light-dark cycle. They were made to acclimatize to the animal house condition for two weeks prior to the commencement of the experiment and were fed with palletised growers mash and water ad libitum. All animals received humane care in accordance with the “guide for the care and use of lab animals” [9]

2.4 Acute Toxicity Assessment

The modified experimental procedure of Kerber [10] was used for the determination of acute toxicity. Fifty-four (54) mice of either sex, weighing between 20 and 25g, were used for acute toxicity study. The mice were randomly divided into eight experimental groups and a control group, with six animals in each group (n=6). The animals were kept in well-ventilated wire-wooden cages. After an overnight fast, the control group received physiological saline, and each of the experimental groups received ethanol extract of Vitellaria paradoxa at doses of 10, 20, 40, 80, 160, 320, 640 and 1280 mg/kg, administered through oral gavage. Animals were weighed before the dose administration and kept under constant observation for 3hr, and for 24hr after administering the extract, to observe any changes in general behaviour or other physiological activities. The animals were humanely euthanized at the end of the study by administering a dose of 100 mg/kg of anaesthetic ketamine intraperitoneally.

2.5 Calculation of Median Lethal Dose (LD₅₀)

For each mouse, the observation was made for 24 hr and symptoms of toxicity and rate of mortality in each group were noted. At the end of study period, expired animals were counted for the calculation of LD₅₀. The arithmetic
method of Karber [10] was used for the determination of \( \text{LD}_{50} \). Hodge and Sterner scale (Table 1) was also used for the evaluation of toxicity with the help of \( \text{LD}_{50} \) [10].

\[
\text{LD}_{50} = \frac{\Sigma (a \times b)}{n}
\]

\( n \) = total number of animal in group
\( a \) = the difference between two successive doses of administered extract/substance
\( b \) = the average number of dead animals in two successive doses.

\( \text{LD}_{100} \) = Lethal dose causing the 100% death of all test animals.

### Table 1. Hodge and Sterner Toxicity Scale

<table>
<thead>
<tr>
<th>S/N</th>
<th>Term</th>
<th>( \text{LD}_{50} ) (mice, oral)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Extremely Toxic</td>
<td>Less than 1 mg/Kg</td>
</tr>
<tr>
<td>2</td>
<td>Highly Toxic</td>
<td>1-50 mg/Kg</td>
</tr>
<tr>
<td>3</td>
<td>Moderately Toxic</td>
<td>50-500 mg/Kg</td>
</tr>
<tr>
<td>4</td>
<td>Slightly Toxic</td>
<td>500-5000 mg/Kg</td>
</tr>
<tr>
<td>5</td>
<td>Practically Non Toxic</td>
<td>5000-15000 mg/Kg</td>
</tr>
</tbody>
</table>

### 2.6 Chronic Toxicity Assessment

Chronic toxicity was carried out in Wistar rats for 28 consecutive days. Twenty rats (n=20) were divided at random into three experimental groups and a control group, with 5 animals in each. After an overnight fast, the control group received physiological saline, and the experimental groups received graded doses of ethanol leaf extract (32 mg/kg (low), 64 mg/kg (medium) and 128 mg/kg (high)) administered orally through gavage for 28 consecutive days. The animals were weighed every 2 days. At the end of the experimental period, blood was collected into lithium heparin bottle, spinned with centrifuge at 3500 rpm and stored at -20°C before the analysis was carried out. Biochemical values were measured by using automatic chemistry analyzer Cobas®Integra 400 plus (Roche Diagnostics Ltd., Switzerland) and parameter assayed were alkaline phosphatase (ALP), alanine transaminase (ALT), aspartate transaminase (AST) and total protein.

#### 2.8 Biochemical Assays

The blood sample was collected into lithium heparin bottle, spinned with centrifuge at 3500 rpm and stored at -20°C before the analysis was carried out. Biochemical values were measured by using automatic chemistry analyzer Cobas®Integra 400 plus (Roche Diagnostics Ltd., Switzerland) and parameter assayed were alkaline phosphatase (ALP), alanine transaminase (ALT), aspartate transaminase (AST) and total protein.

### 2.9 Histopathological Preparations of the Tissues

Immediately after animal sacrifice, the liver was removed and fixed in 10% buffered formalin. The tissues were furthered subjected to conventional processing technique (dehydration, clearing and infiltration) and subsequently embedded in paraffin wax. Sections of 5 μm were obtained by using Leica RM 2115-rotary microtome. These sections were stained with Haematoxylin and Eosin for light microscopy. Photomicrographs were taken at ×100 magnification through a spinning disc laser confocal system (Nikon Eclipse 80i.) equipped with Nikon Microphotography system (DS-Fi1, NIS-Elements BR 3.2 software). Histopathological examination was performed on the organs to determine the presence of lesions.

Data from body weight, biochemical and haematological analysis were subjected to one-way analysis of variance (ANOVA) and Tukey test was used for multiple comparisons post hoc. The results were expressed as group mean ± standard error of mean, while the level of significance was \( p < 0.05 \).

### 3.0 RESULTS

#### 3.1 Acute Toxicity Study

This study showed the toxicity of ethanolic leaf extract of *Vitellaria paradoxa* with the \( \text{LD}_{100} \) at dose of 1280 mg/kg body weight of the treated animals (Table 2). Total mortality was recorded after 12 hours of extract administration. At this dose the experimental animal displayed abnormality in the parameter used for the assessment of the toxicity, these include severe twitching, increased rate of respiration, sedation, abdominal muscle contractions, increased motor activity, bradypnea, cyanosis (purple mucous membrane of tail and nail) and piloerection, comma and death. At the varied doses of 80, 160 and 320 mg/kg (Table 2), the treated animal showed moderate to severe twitching, salivation, abdominal muscle contraction and piloerection. The survival animal appeared normal after 24 hours of extract administration. The gross pathology result revealed no remarkable lesions in the survival animal when compared with the control. However, at lower limit doses of 10, 20 and 40 mg/kg body weight (Table 2), the response of the animals were found to be normal and...
similar to that of the control. No mortality of the experimental animal was observed.

3.2 Determination of LD<sub>50</sub> from Acute toxicity study

The LD<sub>50</sub> value of ethanolic leaf extract of <i>V. Paradoxa</i> was found to be 640mg/kg body weight (Table 2) based on the animal’s observation and calculation by Karber [10]. According to Hodge and Sterner [11] toxicity scale, the LD50 of <i>V. Paradoxa</i> was classified to be slightly toxic (Table 1).

3.3 Chronic toxicity study

For the chronic study, the low dose was expressed as 1/20th LD<sub>50</sub>=32mg/kg body weight, medium dose was expressed as 1/10th LD50=64mg/kg body weight and high dose was expressed as 1/5th LD<sub>50</sub>=128mg/kg body weight. The following results were obtained

3.4 Body Weight and Relative Liver Weight (RLW) Assessments

There was no significant difference (p>0.05) in the BW of the exposed rats and the control during the first week of treatment (Figure 1). However, significant dose-dependent bodyweight decreases were consistently observed in weeks 2, 3 and 4 (Figure 1). The severity was more marked in the bodyweight of rats exposed to 128mg/kg dose of <i>Vitellaria paradoxa</i>. There was no significant difference (p>0.05) in the RLW of rats exposed to the lower doses (32 and 64mg/kg) of <i>Vitellaria paradoxa</i> compared to the control (Figure 1). Conversely, the RLW was significantly increased (p<0.05) in the rats exposed to 128 mg/kg of <i>V. paradoxa</i> relative to other groups (Figure 2).

3.5 Haematological Parameters

After oral administration of graded doses (32 mg/kg, 64 mg/kg and 128 mg/kg) of ethanolic leaf extract of <i>V. paradoxa</i> for 28 consecutive days (Table 3), there was no significant difference (p>0.05) in the values of all the haematological parameters (WBC, RBC, Hb Conc., PCV, MCV, MCH, MCHC and PLT) when compared with their respective controls (Table 4). However, platelet mean value (687.00±356.62) of rats that received the moderate dose (64 mg/kg) of <i>V. paradoxa</i> increased significantly (p<0.05) when compared with its corresponding control values (475.67±133.34) (Table 3)

3.6 Biochemical Parameters

The effect of the chronic exposure of rats to different doses (32 mg/kg, 64 mg/kg and 128 mg/kg) of <i>Vitellaria paradoxa</i> on the hepatic enzymes is shown in Table 4. The result revealed significantly increased (p<0.05) mean value of the hepatic enzymes (ALT, AST, ALP) of rats orally administered at 64 mg/kg and 128 mg/kg body weight of <i>V. paradoxa</i> when compared with their respective control values. However, the hepatic enzymes of rats exposed to 32 mg/kg of <i>Vitellaria paradoxa</i> insignificantly increased (p>0.05) relative to their corresponding controls.

3.7 Histopathology
Table 4. Changes in the biochemical parameters of experimental animals exposed to different doses of ethanolic extract of *Vitellaria paradoxa*

<table>
<thead>
<tr>
<th>Biochemical Parameters</th>
<th>Control</th>
<th>32 mg/kg</th>
<th>64 mg/kg</th>
<th>128 mg/kg</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>AST (IU/L)</td>
<td>9.00 ± 2.74&lt;sup&gt;a&lt;/sup&gt;</td>
<td>10.00 ± 3.67&lt;sup&gt;a&lt;/sup&gt;</td>
<td>14.47 ± 1.95&lt;sup&gt;b&lt;/sup&gt;</td>
<td>17.75 ± 2.06&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.0021</td>
</tr>
<tr>
<td>ALT (IU/L)</td>
<td>10.20 ± 2.17&lt;sup&gt;a&lt;/sup&gt;</td>
<td>11.40 ± 2.51&lt;sup&gt;a&lt;/sup&gt;</td>
<td>15.00 ± 1.73&lt;sup&gt;b&lt;/sup&gt;</td>
<td>16.00 ± 2.45&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.0034</td>
</tr>
<tr>
<td>ALP (IU/L)</td>
<td>36.00 ± 7.78&lt;sup&gt;a&lt;/sup&gt;</td>
<td>40.60 ± 9.48&lt;sup&gt;a&lt;/sup&gt;</td>
<td>52.60 ± 6.19&lt;sup&gt;b&lt;/sup&gt;</td>
<td>55.75 ± 6.13&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.0045</td>
</tr>
</tbody>
</table>

Values in the same row with different superscripts are significantly different; *AST*: Aspartate Aminotransferase, *ALT*: Alanine Aminotransferase, *ALP*: Alkaline Phosphatase

Table 3. Haematological profiles of experimental animals exposed to different doses of ethanolic extract of *Vitellaria paradoxa*

<table>
<thead>
<tr>
<th>Haematological parameters</th>
<th>Control</th>
<th>32 mg/kg</th>
<th>64 mg/kg</th>
<th>128 mg/kg</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>WBC (10&lt;sup&gt;9&lt;/sup&gt;/L)</td>
<td>3.47 ± 0.74&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.40 ± 1.26&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.12 ± 2.03&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.45 ± 0.79&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.4051</td>
</tr>
<tr>
<td>RBC (10&lt;sup&gt;12&lt;/sup&gt;/L)</td>
<td>6.32 ± 0.35&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.92 ± 0.77&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.68 ± 1.25&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.56 ± 1.37&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.6123</td>
</tr>
<tr>
<td>Hb Conc. (g/dl)</td>
<td>10.20 ± 0.42&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.88 ± 1.25&lt;sup&gt;a&lt;/sup&gt;</td>
<td>8.76 ± 1.81&lt;sup&gt;a&lt;/sup&gt;</td>
<td>10.70 ± 2.13&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.4200</td>
</tr>
<tr>
<td>PCV (%)</td>
<td>36.54 ± 1.33&lt;sup&gt;a&lt;/sup&gt;</td>
<td>28.28 ± 5.07&lt;sup&gt;a&lt;/sup&gt;</td>
<td>31.97 ± 6.64&lt;sup&gt;a&lt;/sup&gt;</td>
<td>37.15 ± 6.66&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.5230</td>
</tr>
<tr>
<td>MCV (fl)</td>
<td>58.00 ± 2.92&lt;sup&gt;a&lt;/sup&gt;</td>
<td>57.40 ± 2.30&lt;sup&gt;a&lt;/sup&gt;</td>
<td>56.60 ± 1.52&lt;sup&gt;a&lt;/sup&gt;</td>
<td>57.00 ± 2.94&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.4900</td>
</tr>
<tr>
<td>MCH (pg)</td>
<td>16.88 ± 1.56&lt;sup&gt;a&lt;/sup&gt;</td>
<td>16.02 ± 0.15&lt;sup&gt;a&lt;/sup&gt;</td>
<td>15.40 ± 0.35&lt;sup&gt;a&lt;/sup&gt;</td>
<td>16.35 ± 0.00&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.3910</td>
</tr>
<tr>
<td>MCHC (g/dl)</td>
<td>27.90 ± 0.42&lt;sup&gt;a&lt;/sup&gt;</td>
<td>28.00 ± 1.18&lt;sup&gt;a&lt;/sup&gt;</td>
<td>27.38 ± 0.75&lt;sup&gt;a&lt;/sup&gt;</td>
<td>28.68 ± 0.78&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.7920</td>
</tr>
<tr>
<td>PLT (10&lt;sup&gt;9&lt;/sup&gt;/L)</td>
<td>383.60 ± 88.27&lt;sup&gt;a&lt;/sup&gt;</td>
<td>299.40 ± 74.78&lt;sup&gt;a&lt;/sup&gt;</td>
<td>687.00 ± 56.62&lt;sup&gt;b&lt;/sup&gt;</td>
<td>437.50 ± 18.39&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.0032</td>
</tr>
</tbody>
</table>


**Figure 2.** Changes in the relative liver weight of experimental animals exposed to different doses of ethanolic extract of *Vitellaria paradoxa* during chronic administration.

*Values with the different alphabet superscripts (a,b) are significantly different*

**Figure 3.** Photomicrographs of the liver of rats exposed to graded doses of *Vitellaria paradoxa*.

A (*Control*): Normal hepatic histo-architecture, B (32 mg/kg of *Vitellaria paradoxa*): Liver parenchyma showed no visible lesion, C (64 mg/kg of *Vitellaria paradoxa*): Moderate central venous congestion (long arrows), with mild diffuse vacuolar degeneration of hepatocytes (small arrows), D (128 mg/kg of *Vitellaria paradoxa*): Liver showed very severe central venous (arrows) and sinusoidal congestion (small arrow) during chronic administration.
Chronic exposure of rat to ethanolic leaf extract of *Vitellaria paradoxa*, at 32 mg/kg body weight (Figure 3B) induced no visible pathological lesion in the liver which was similar to that of the control animals (Figure 3A) where there was distinctly and relatively normal hepatocytes architecture and cord arrangement. However, medium (64 mg/kg) and high (128 mg/kg) doses of *Vitellaria paradoxa*, induced several pathological changes in the liver that range from moderate to severe central venous and sinusoidal congestion and diffuse hepatocyte vacuolar degeneration (Figures 3C & D). Damage to hepatic cell architecture was more pronounced with the high dose of 128mg/kg (Figure 3D) than that of the medium dose of (64mg/kg) (Figure C) when compared with the control (Figure 3A).

**4.0 DISCUSSION**

In the present study, the LD₅₀ of ethanolic leaf extract of *Vitellaria paradoxa* in mice gavaged at doses ranging from 10 to 1280 mg/kg was found to be 640 mg/kg body wt. The dose fall within the range categorized a slightly toxic dose by Hodg and Sturmer [11]. This finding is in agreement with the toxic concentration earlier reported for the root extract of *Vitellaria paradoxa* [12]. However, Mainasara [5] observed non toxic effect of stem bark extract of *V. paradoxa* after oral administration in male wistar rats. These discrepancies may be due to the effects of some toxic metabolites that may occur in different plant parts or variations in photochemical constituents from different plant sources.

The body and organ weights are essential indicators of toxicity whose alterations usually precede morphological changes [13, 14]. Therefore, the observed significant dose-dependent bodyweight decreases from the 2nd to the 4th week of exposure to the extract could be suggestive of toxic potential of the plant most especially to the higher doses of this plant. In addition, the markedly increased relative liver weight observed in the rat exposed to 128mg/kg dose of *Vitellaria paradoxa* further affirms the possible toxic effect of this plant. However, the increase in relative liver weight is an interesting finding which calls for further study to unravel the potential underlining mechanism. The alteration in the bodyweight and hematological index (relative liver weight) partially agrees with the reports on *Eclipta alba* [15]. It is however at variance with documentation of increased bodyweight sequell to the exposure of rats to plants like *Maerua crassifolia* [16] and unripe *Carica papaya* [17]. Haematological parameters are related to blood and blood-forming organs and usually act as a pathological reflector of the status of animals exposed to toxicants and other conditions [18, 19, 20]. Blood parameters in a toxicity testing also have a great predictive value for human toxicity when findings from animal studies are translated to the human population. Therefore, the non-significant difference observed in all the blood indices (red blood count, haemoglobin concentration, pack cell volume, white blood count, mean haemoglobin concentration, mean corpuscular volume and mean corpuscular haemoglobin concentration) suggested that chronic exposure of *Vitellaria paradoxa* does not precipitate haematological disorders in Wistar rats and mice. This finding is consistent with reports on haemotoxicty assessments of *Moringa oleifera* seed [21] and *Cucurbita maxima* seed extract [22]. However, our finding is incongruent with the report of significant reduction in the haematological indices by *Azadirachta indica* stem bark extract [23].

Hepatic enzymes are of great relevance in clinical and toxicological studies because of their usefulness as a predictor of liver injury [24]. The damage to hepatic cells usually leads to the release of their enzymes (alanine aminotransferase, aspartate aminotransferase and alkaline phosphatase) into bloodstream and their levels are significantly elevated in a typical liver damage [25]. Thus, the significantly increased serum hepatic enzymes values observed sequel to the administration of graded doses of *Vitellaria paradoxa* leaf extracts more particularly the higher doses (64 mg/kg and 128 mg/kg) appeared to reflect the dose-dependent hepato-toxic potential of this plant. The observed hepatic enzyme profiles agreed with the report on similar toxic plant like *Azadirachta indica* by Ashafa et al., [23] but contradicts the findings of Ajibade et al., [21] and Awodele et al., [26] on hepatic enzymes profiles in Wistar rats exposed to *Moringa oleifera*.

The hepatic histolopathological results from this study were typified by classical lesions of liver toxicities; mild to severe central and sinusoidal congestion, hepatic degeneration, and necrosis with loss of cord arrangement most especially at the higher doses of the plant. These findings further strengthened results on the liver enzymes. On the other hand, the absence of hepatic histoarchitectural distortion observed with the exposure to 32 mg/kg dose *Vitellaria paradoxa* seemed to indicate that *Vitellaria paradoxa* is safe at this dosage. This finding is similar to the report of Falana et al., [12] on the root extract of *Vitellaria paradoxa*.

To the best of our knowledge, this is the first report scrutinizing the safety of oral consumption of ethanolic leaf extract of *V. paradoxa* and this result indicates that safe therapeutic dosage (32 mg/kg) must be considered for both short and long term consumption. Based on the findings laid to bare in this study, it suffices to conclude that *Vitellaria paradoxa* seems to be unsafe following a prolonged administration. Therefore, caution should be taken in both short and long term usage. Further studies on phytochemical profiles, proximal analysis and chronic
toxicity should be investigated.

Conflict of Interest

The authors declare that there is no conflict of interest.

Authors Contribution

ROF conceived and designed the study, collected data and wrote the result section of the manuscript; JOO contributed to data analysis tools, performed data analysis and wrote the discussion section of the manuscript; IAA contributed to data analysis and wrote the introductory aspect of the manuscript; NJP wrote the methodology section of the manuscript.

References


