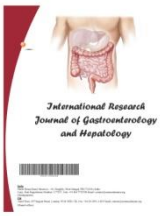

International Research Journal of Gastroenterology and Hepatology

5(2): 38-42, 2022; Article no.IRJGH.86439

Evaluation of the Effect of Ethanolic Extract of *Solanum torvum* Leaf on Liver of Treated Rats

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

Article Information

Open Peer Review History:
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Original Research Article

Received 12 February 2022
Accepted 22 April 2022
Published 28 April 2022

ABSTRACT

The aim of this study was to evaluate the effect of ethanolic extract of *Solanum torvum* leaf on the liver of treated Wistar rats. Freshly harvested leaves of *S.torvum* were shade dried and ground to fine powder. 500 g of powdered plant sample was macerated in ethanol for 72 hrs. Twenty adult male Wistar rats were divided into four groups of five rats each. Group 1 was the normal control and was fed normal rat feed and water only, Group II was administered with 100 mg/kg of the extract, and Group III was administered with 200 mg/kg, while Group IV was administered with 300 mg/kg b.w of extract orally. Animals were sacrificed after which blood sample was collected and tissue sample harvested and subsequently analyzed using standard procedures. The results obtained from this study show that administration of aqueous extract of *S. torvum* increased the activity of the liver enzymes as well as the levels of the conjugated and total bilirubin in a dose-dependent manner. However, there was no significant (P>0.05) difference in enzyme activity as well as the levels of conjugated and total bilirubin recorded with 100 mg/kg of extract of *S. torvum* and the control. In conclusion, it can be deduced from this study that consumption of *S. torvum* leaf may be toxic at high doses.

Keywords: Bilirubin; enzyme; liver; solanum torvum.

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1. INTRODUCTION

The use of medicinal plants in the treatment of diseases is practiced by over 80% of the world's population [1]. It is a practice that has stood the test of time [2] primarily owing to its reliability, accessibility and affordability [3]. Plants generally contain diverse arrays of compounds many of which may be toxic when consumed in large quantities [4] notable instance being the alkaloids of *Solanaceaes* a family of plants to which *Solanum torvan* belongs [5].

Solanum torvan commonly known as Turkey berry represents one of the most economically and medicinally important families of angiosperms (Jenifer et al., 1997). It is a small solanacerous shrub which is predominantly cultivated in Africa and West Indies [6]. Research efforts have established that the stem and root of *S. torvum* have anti-tumor, anti-bacterial, anti-viral and anti-inflammatory properties [7]. The fruit and leaf are widely used in Cameroonian folk medicine. The fruit is prepared as a decoction for the treatment of cough and is considered useful in the management of liver enlargement [8].

The liver is an organ as well as the site for essential biochemical reactions in the human body. It detoxifies toxic substances and synthesizes biomolecules and can be damaged by a number of agents including herbal drugs [9]. Therefore, it is imperative to probe the reliability of the extract *S. torvum* by evaluating its effect on the liver.

2. MATERIALS AND METHODS

2.1 Collection and Processing of Plant Material

Mature green leaves of *Solanum torvum* were obtained from a home garden in Uli, Ihiala Local Government Area of Anambra State and was identified and authenticated at the herbarium unit of the Department of Botany, Nnamdi Azikiwe University Awka Anambra State. The leaves were thoroughly washed with clean tap water and afterwards dried at room temperature. The dried leaves were subsequently ground and sieved to a fine powder. Exactly 500 g of powdered plant sample was suspended in 1000 mL of 95% ethanol for 72 hours and agitated thrice daily. It was then filtered using a muslin cloth and further filtration with Whatman No 1 filter paper. The filtrate was concentrated.

2.2 Animals

Adult male Wistar rats weighing 150-200 g were housed in plastic cages in the Animal House of the Department of Human Anatomy, College of Health Sciences Anambra State University, and were fed rat feed and water *ad libitium*. They were acclimatized for two weeks.

2.3 Median Lethal dose is 50% (LD50)

The determination of the acute toxicity test on extract involved three groups of three Wistar rats each. The groups were separately administered 10, 100, and 1000 mg/kg of extract orally. The rats were observed for 24 hrs for effects of toxicity. Being that mortality was not observed in any of the groups, another three groups of one rat each were each administered with 1600, 2900, and 5000 mg/kg of extract separately. The animals were observed for 48 hrs for signs of toxicity [10].

2.4 Animal Grouping

Twenty adult Wistar rats were divided into four groups of five rats

Group I: was fed with rat feed and water *ad libitum*.
Group II: was administered with100 mg/kg of *Solanum torvum* leaf extract
Group III: was administered with 200 mg/kg of *Solanum torvum* leaf extract
Group IV: was administered with 300 mg/kg of *Solanum torvum* leaf extract

2.5 Collection of Blood Sample

Administration of extract lasted for 30 days. After which the animals were sacrificed and a blood sample was collected by cardiac puncture. The blood sample was centrifuged at 4 °C, 500 ×g for 15 minutes to obtain serum.

2.6 Evaluation of Serum Hepatomarkers

The colorimetric method was employed to evaluate the activity of Alanine aminotransaminase (ALT), alkaline phosphatase (ALP), aspartate aminotransaminase (AST), bilirubin in the serum (Genet et al., 2000) with the aid of the Randox diagnostic kits (USA). Pyruvate solutions of varied millimolar concentrations were used to prepare a standard curve from which AST activities were computed

as described by [11]. Alanine aminotransaminase (ALT) assay was performed as described for AST except that 200 Mm DL-Alanine replaced L-Aspartate in the procedures.

2.7 Histopathological Study

Harvested liver tissue was fixed process and was subsequently dehydrated in 90% alcohol. The liver tissue was further processed in accordance to the method described by Burki et al [12].

2.8 Statistical Analysis

All data were expressed as mean ± standard deviation. One-way analysis of variance (ANOVA) and Duncan test was carried out to test significant differences between their means. P≤05 was considered statistically significant.

3. RESULTS

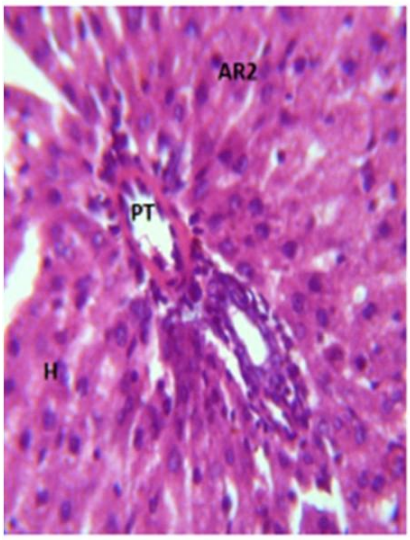

Plate 1: *is the photomicrograph of the liver of rats (control) showing a well perfused normallobular architecture with central vain*

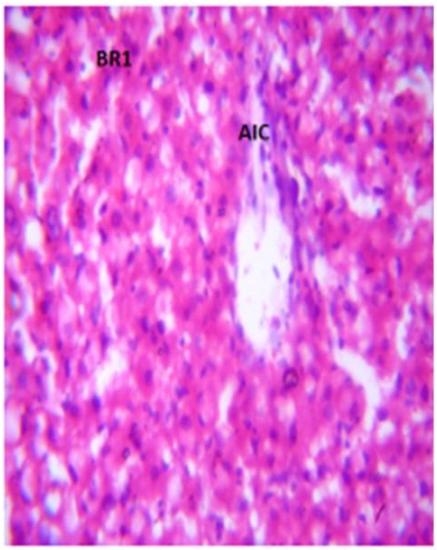

Plate 2: *is the photomicrograph of the liver of rats 100 mg/kg of extract showing a well perfused hepatic tissue with mild aggregate of inflammatory cell around the central vain (AIC) and moderate fatty deposit on the background.*

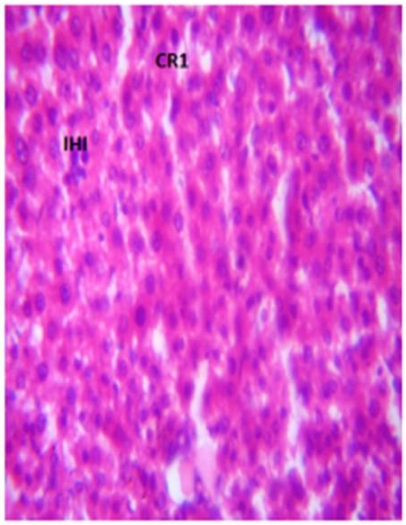

Plate 3: *is the photomicrograph of the liver of rats administered with 200 mg/kg of extract showing a well perfused hepatic tissue with mild aggregate of inflammatory cell around the central vain (AIC) and moderate fatty deposit on the background.*

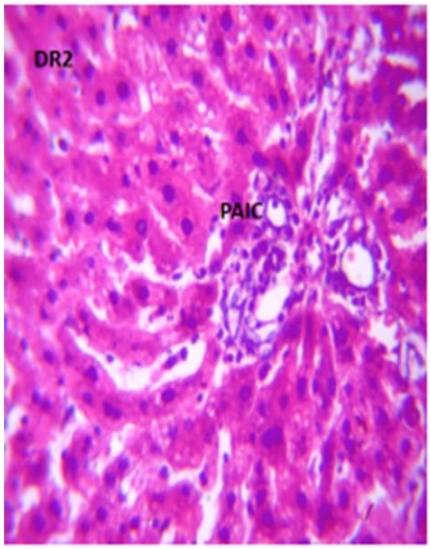

Plate 4: *is the photomicrograph of the liver of rats administered with 300 mg/kg of extract showing a well-perfused hepatic tissue with moderate portal aggregate inflammatory cell (PAIC).*

Table 1. Serum Hepatomarkers of Rats treated with Ethanolic Extract of *Solanum torvum*

Groups	Treatment	AST (UI/L)	ALT (UI/L)	ALP (UI/L)	Conjugated Bilirubin (mg/dl)	Total Bilirubin (mg/dl)
Group I	Feed+ H_2O	8.67 ± 0.88^{a}	7.00 ± 0.57^{a}	114.67 ± 6.64^{a}	1.50 ± 0.17^{a}	10.00 ± 0.95^{a}
Group II	100 mg/kg	9.00 ± 1.15^{ab}	7.67 ± 1.45^{a}	126.67 ± 5.69^{b}	1.67 ± 0.15^{ab}	10.04 ± 0.00^{ab}
Group III	200 mg/kg	10.67 ± 2.02^{c}	9.00 ± 2.88^{b}	129.67 ± 9.34^{c}	1.87 ± 0.08^{c}	11.07 ± 0.43^{b}
Group IV	300 mg/kg	14.67 ± 0.33^{d}	14.00 ± 0.58^{c}	130.67 ± 6.64^{d}	2.07 ± 0.03^{d}	11.10 ± 0.06^{bc}

Results are expressed as mean ± standard deviation of three determinations. Values with a different superscript in a column are significant (P<0.05)

4. DISCUSSION

Plants generally are the repository of bioactive compounds many of which may toxic when ingested in large amounts (Philomena et al. 2009) notable instance is the alkaloids of *Solanaceaes* [5]. The liver is the site for essential biochemical reactions in the human body chiefly concerned with the detoxification of toxic substances as well as the synthesis of useful biomolecules. The liver is susceptible to pathological agents one of which is herbal medicines [9], and when damaged translates to grave consequences. Table 1 shows the activity of serum hepatomarkers of rats administered with ethanolic extract of *Solanum torvum* indicating a dose-dependent increase in the activity of serum hepatomarkers (Alanine aminotransaminase (ALT), alkaline phosphatase (ALP), aspartate aminotransaminase (AST), bilirubin). However, there was no significant ($P<0.05$) difference in the activity of the enzymes in the serum obtained from rats administered with 100 mg/kg compared to the control, this was contrary to the observation made on alkaline phosphatase (ALP) which was significantly ($P<0.05$) higher than that reported for the control group administered with only feed and water. This could be attributed to the antioxidant property of *S. torvum* being that oxidative stress orchestrated by free radicals generated through cellular activities had been implicated in hepatic damage [13]. This result is consistent with the finding of Vrushali et al. [14] which established that treatment with *S.torvum* significantly protected against monosodium glutamate (MSG) induced hepatic damage evident by the reversal of MSG induced histopathological changes following treatment with the said extract. This is consolidated by the fact oxidative stress-related problems are controlled using herbs, thus underscoring the essentiality of herbs in the management of human diseases owing to their antioxidant property [15]. Liver damage caused by 200 mg/kg of *S. torvum* was evident by the presence of a well-perfused hepatic tissue with the mild aggregate of the inflammatory cell around the central vein (AIC) and moderate fatty deposit in the background this was advanced with the administration of 300 mg/kg of *S. torvum* with moderate portal aggregate inflammatory cell (PAIC). This could be as a result of the presence of alkaloids found in *Solanaceaes* which can be harmful when consumed in large quantities.

5. CONCLUSION

It can be deduced from this study that *Solanum torvum* which is conventionally considered safe for human consumption could be hepatotoxic at high doses.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

CONSENT

It is not applicable.

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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