Evaluation of the Effect of Aqueous Extract of *Solanum torvum* Leaf on Liver of treated rats

Abstract

The aim of this study was to evaluate the effect of aqueous extract of *Solanum torvum* leaf on the liver of treated rats. Freshly harvested leaves of *S.torvum* were shade dried and ground to fine powder. 500 g of powdered plant sample was macerated in water for 72 hrs. Twenty five adult male wistar rats were divided into five 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 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, blood 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 and as well as the levels of conjugated and total bilurubin 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.

Comment [A1]: In MATERIALS AND METHODS part mentioned total rats 20 rats, here mentioned 25 rats. Correct the no of rats taken for this study and grouping.

Keywords: *Solanum torvum*, Liver, Enzyme, Bilirubin,

Introduction

The use of medicinal plants in the treatment of diseases is practiced by over 80% of the world's population (Kimpouni et al., 2018). It is a practice that has stood the test of time (Klotoe et al., 2013) primarily owing to its reliability, accessibility and affordability (Bafor, 2017). Plants generally contain diverse arrays of compound many of which may toxic when consumed in large quantities (Philomena et al. 2009) notable instance being the alkaloids of *Solanaceaes* (Boullata and Nacen, 2000).

Solanum torvan commonly known as Turkey berry belongs to the *Solanaceae* family and represent one of the most economically and medicinally important family of angiosperms (Jenifer et al., 1997). *S. torvun* is a small solanacerous shrub which is predominantly cultivated

in Africa and West Indies (Adjanohoun, 1996). Research efforts have established that the stem and root of *S. torvum* have anti-tumour, anti-bacterial, anti-viral and anti-inflammatory properties (Zubaida, 2013). The fruits 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 liver enlargement (Siemonsma, 1994).

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 (Evans, 2002). Therefore, it is imperative to probe the reliability of the extract *S. torvum* by evaluating its effect on the liver.

MATERIALS AND METHODS

Collection and Processing of Plant Material

Mature green leaves of *Solanum torvum* was ontained from a home garden in Uli, Ihiala Local Government Area of Anambra State was identified and authenticated at the herbarium unit of the Department of Botany, Nnamdi Azikiwe University Awka Anambra State. The leaves were throughly washed with clean tap water and afterwards dried at room temperature. The dried leaves were subsequently ground and sieved to fine powder.

Comment [A2]: obtained

Animals

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

Median Lethal dose 50% (LD50)

The determination of the acute toxicity test on extract involved three groups of three wistar rats each. The groups were separately administered with 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 was each administered with 1600, 2900 and 5000 mg/kg of extract separately. The animals were observed for 48 hrs for signs of toxicity (Lorke, 1983).

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

Collection of blood sample

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

Comment [A3]: Mention about standard reference for this study

Evaluation of Serum Hepatomarkers

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

Comment [A4]: This in text reference missing in reference section

varied millimolar concentrations were used to prepare a standard curve from which AST activities were computed as described by (Varley, 1980). Alanine aminotransaminase (ALT) assay was performed as described for AST except that 200Mm DL-Alanine replaced L-Aspartate in the procedures.

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. (2020).

Statistical Analysis

All data were expressed as mean ± standard deviation. One-way analysis of variance (ANOVA) and Duncan test was carried out to test any significant differences between their means. $P \leq 0.5$ were considered statistically significant.

RESULTS

Table 1: Serum Hepatomarkers of Rats treated with Aqueous 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 different superscript in a column are significantly ($P<0.05$).

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).*

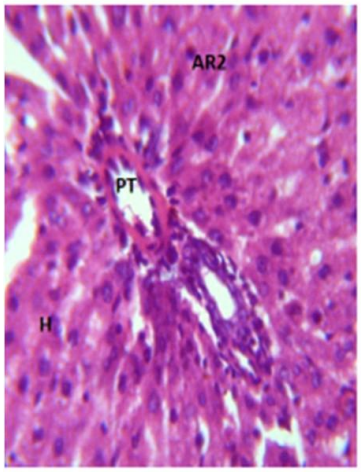

Plate 1: *is the photomicrograph of the liver of rats (control) showing a well perfused normallobular architecture with central vain*

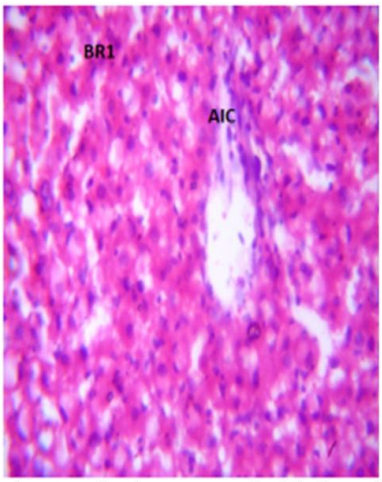

Plate 2: *is the photomicrograph of the liver of rats 100 mg/kg of extract showing a well perfused hepatic tissue with mild aggregate of inflammatory cell around the central vain (AIC) and moderate fatty deposit on the background.*

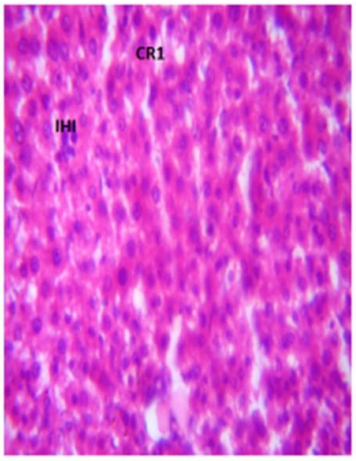

Plate 3: *is the photomicrograph of the liver of rats administered with 200 mg/kg of extract showing a well perfused hepatic tissue with mild aggregate of inflammatory cell around the central vain (AIC) and moderate fatty deposit on the background.*

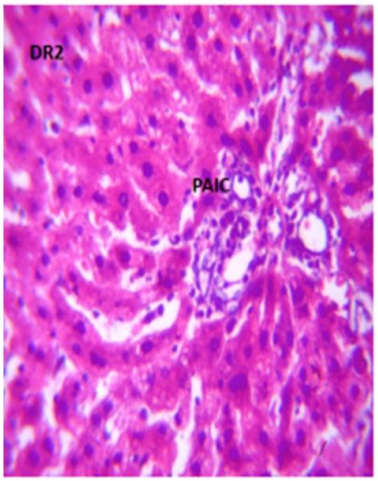

Plate 4: *is the photomicrograph of the liver of rats administered with 300 mg/kg of extract showing a well-perfused hepatic tissue with moderate portal aggregate inflammatory cell (PAIC).*

Discussion

Plants generally are repository of bioactive compounds many of which may toxic when ingested in large amounts (Philomena et al. 2009) notable instance being the alkaloids of *Solanaceaes* (Boullata and Nacen, 2000). The liver is the site for essential biochemical reaction in the human body chiefly concerned with detoxification toxic substances as well as synthesis of useful biomolecules. The liver is susceptible to pathological agents one of which is herbal medicines (Evans, 2002) and when damaged translates to grave consequences. Table 1 shows the activity of serum hepatomarkers of rats administered with aqueous 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 ($P<0.05$) 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 (Gandhiappan and Rengasamy, 2012). This result is consistent with the finding of Vrushali *et al*. (2019) 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 for 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. Liver damage caused by 200 mg/kg of *S. torvum* was evident by the presence of a well perfused hepatic tissue with mild aggregate of

inflammatory cell around the central vain (AIC) and moderate fatty deposit on the background this was advanced with the administration of 300 mg/kg of *S. torvum* which a well-perfused hepatic tissue 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.

Comment [A5]: Central vein

CONCLUSION

It can be deduced from this study that which conventionally considered safe to human consumption could be hepatotoxic at high doses.

Comment [A6]: In conclusion mention, at what dose safe for human consumption from your study.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that no competing interests exist. 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.

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