EUROPEAN JOURNAL OF BIOMEDICAL AND PHARMACEUTICAL SCIENCES
http://www.ejbps.com

ISSN 2349-8870
Volume: 11
Issue: 5
298-306
Year: 2024

EFFECT OF AQUEOUS *MIMOSA PUDICA* EXTRACT IN SULPHONAMIDE-INDUCED LIVER DISEASE IN ALBINO WISTAR RATS

Usiobeigbe O. S[1]., Omolumen L.E.[1], Airhomwanbor K.O.[1], Ugege C.[2], Asibor E.[3], Ikede R.E.[4], Ayeni O.M.[5]

[1]Department of Chemical Pathology, Faculty of Medical Laboratory Science, Ambrose Alli University, Ekpoma, Edo State, Nigeria.
[2]Department of Medical Laboratory Science, Edo University, Uzairue, Edo State, Nigeria.
[3]Department of Histopathology and Cytopathology, Faculty of Medical Laboratory Science, Ambrose Alli University, Ekpoma, Edo State, Nigeria.
[4]Federal College of Medical Laboratory Science and Technology, Jos, Plateau State, Nigeria.
[5]Department of Medical Laboratory Science, Faculty of Basic Medical and Applied Sciences, Lead City University, Ibadan Oyo State, Nigeria.

***Corresponding Author: Usiobeigbe O. S.**
Department of Chemical Pathology, Faculty of Medical Laboratory Science, Ambrose Alli University, Ekpoma, Edo State, Nigeria.

Article Received on 25/03/2024 **Article Revised on 15/04/2024** **Article Accepted on 05/05/2024**

ABSTRACT

Mimosa pudica comes from the word "mimic", which hints at leaf sensitivity, and "pudika", which means shy, modest, or shy. Mimosa mimics the susceptibility of animals to sundew, which responds to contact with insects, such as light, time, and gravity. Plants have played a significant role in maintaining human health and improving the quality of human life for thousands of years and have served humans well as valuable components of medicines, seasonings, beverages, cosmetics and dye. This topic is aimed to study the effect of *Mimosa pudica* in sulphonamide-induced liver disease in albino wistar rat. Liver damage in rats caused using sulphonamide (1ml/kg /bw), administered orally. Parameters such as serum alkaline phosphatase (ALP) and bilirubin (total and direct). Silymarin (100mg/kg) was used as the standard drug. The effects of ethanolic extract of *Mimosa pudica* (400mg/kg) was observed on the following parameters. One group was given both ethanolic extract of *Mimosa pudica* and Silymarin to observe if there was any additive effect. The statistical analysis of data was done by using Chi-Square. There was comparison of the mean values of the liver function parameters in Group 1 where there was no administration of liver inducing agent like Sulphonamide or the liver damage reversers like the plant extract *Mimosa pudica* or the Standard drug (silymarin), with the same parameters in other groups of different patterns of treatment. There was statistically significant increase in the mean values of serum alanine transaminase, aspartate transaminase, total protein, albumin, globulin, alkaline phosphatase, gamma-glutamyl transferase and AST/ALT ratio in Group 2, Group 4 and Group 5 with p-values ($p<0.01$), ($p<0.01$), ($p<0.01$), ($p<0.05$), ($p<0.01$), ($p<0.01$), and ($p<0.01$) respectively. This shows that the liver damage was not reversed where there was no administration of liver damage reversing agent, also, the administration of 100mg and 200mg of plant extract *Mimosa pudica* were not sufficient to reverse the damage caused to the liver and administration of 300mg of *Mimosa pudica* was enough to reverse the liver disease. This study shows that *Mimosa pudica* extract was potent enough to reverse liver- induced disease. It also shows that certain concentration (300mg) of *Mimosa pudica* extract was used to reverse the liver-induced disease. Finally, the study shows that there is a significant relationship between liver enzymes and liver disease.

KEYWORDS: *Mimosa pudica*, Liver disease, Sulphonamide, Wistar rat, Livere parameters.

INTRODUCTION

Plants have played an important role in maintaining human health and improving people's quality of life for thousands of years, serving people as a valuable ingredient in medicines, spices, beverages, cosmetics and dyes. Chinese herbs assume that the plant contains natural substances that can promote health and reduce disease. Recently, the focus on plant research has increased around the world, and much evidence has accumulated showing the immense potential of medicinal plants used in various traditional systems (Kaur *et al.*, 2012).

Mimosa pudica comes from the word "mimic", which hints at leaf sensitivity, and "pudika", which means shy, modest, or shy. Mimosa mimics the susceptibility of animals to sundew, which responds to contact with insects, such as light, time, and gravity (Kaur *et al.*, 2012). Sleeping grass (Tropical Biology Association). Mimosa is a small, deciduous or ascending, short-lived shrub. *Mimosa pudica* has attracted the attention of researchers around the world for its pharmacological actions such as anti-diabetes, anti-toxin, anti-hepatoxin, antioxidant and wound healing activity *Mimosa pudica* (Family: Leguminosae) is a small or middle-sized tree, about 1.5 m (5 ft) in height cultivated throughout India. Some authors consider it a woody herb. When supported by other vegetation, the height can reach 1 m and the horizontal range can exceed 2 m. The reddish-brown woody stems are sparsely or densely armed with curved thorns. The root system is composed of a wide range of fibrous roots with taproots and nodules. The branches are thin and flexible, with one or two pairs of pinna and 15-25 pairs of leaves with rectangular leaflets 3-12 mm long. The flowers are pink and gather on a spherical head. Legumes (pods) are straight, 1.0-1.5 cm long, 3 mm wide, with bristles on the edges. The pods are born in groups and contain 2-4 brown seeds (Kumaresan *et al.*, 2015). It is a versatile tree used as vegetables, spices, oils for cooking and cosmetics, and medicinal plants. It is known as Sensitive plant in English, Ajalikalika in Sanskrit, Lajawanti in Hindi, Lajjabate in Bangali, Hadergitte in Kannada, Kasirottam in Tamil and Manugumaramu in Telgu. It is reported to contain alkaloid, glycoside, flavonoid and tannis. It is used in suppresses kapha and pitta Heals wounds, Coagulates blood and sexsul weakness (Kumaresan *et al.*, 2015). All parts of the tree are considered medicinal and are used to treat bile, leprosy, diarrhea, vaginal and uterine diseases, inflammation, burning sensation, malaise, asthma, cataracts, blood disorders and more. It relieves, replaces and benefits blood impurities and diseases caused by bile, bile fever, hemorrhoids, dysentery and leprosy. According to the Unani system of medicine, root is resolvent, alternative, useful in diseases arising from blood impurities and bile, bilious fevers, piles, jaundice, leprosy etc. Its extract immobilizes the filariform larvae of *Strongyloides stercoralis* in less than one hour. In modern medicine, *Mimosa pudica* is being studied for its potential to produce new chemotherapeutic compounds. It contains an alkaloid called mimosine, which has been found to have potent antiproliferative and apoptotic effects. Aqueous extracts of the roots of the plant have shown significant neutralizing effects on the lethality of the venom of the monocled cobra Mahanta & Mukherjee, **(**2013). It seems to inhibit the myotoxicity and enzyme activity of cobra venom. *Mimosa pudica* contains the toxic alkaloid mimosine.

Chronic liver disease is one of the major health issues which occur throughout the world irrespective of age, sex, region or race. Liver diseases have being ranked the fifth most common cause of death and the second leading cause of mortality amongst all digestive diseases with approximately 2 million deaths per year worldwide. Aimed at determining the relative prevalence of chronic liver diseases in Nigeria, this shows that up to 46% of global diseases and 59% of the mortality is due to chronic liver diseases and almost 35 million people in the world die of chronic diseases with liver disease rate steadily increasing over the years. In Nigeria, (35 million) 2-20% of the population, are infected with hepatitis B and C virus with a prevalence rate of 4.3%-23.3% and 0.5-15% been reported respectively from different part of the country depending on the geographical location. A prevalence rate of 4.3% was reported from Port Harcourt, 5.7% from Ilorin, 11.6% from Maiduguri, and 8.3% from Zaria, 6.78% from Ado-Ekiti among pregnant women, 13.50% from Lagos, 11.50% from Abuja Urban among HIV Patients with a seroprevalence of 23.3% been reported among patients attending all clinics in Kano. Despite intensive work of research by scientists to solve this menace, little or no result has been achieved over the decades. Hence the need to raise animal model in finding justification of why and how sulphonomide-induced liver disease is effectively reversed by *Mimosa pudica*.

MATERIALS AND METHODS

Study Area: This study was carried out in Lead City University, Ibadan, Oyo-state, Nigeria.

Research Design: Seven (7) cages was used for the experiment. Each cages contains six (6) male wistar rats which is divided into 7groups (Arokiyaraj *et al.*, 2012).
Group 1: Rats + food and water; this is a negative control.
Group 2: Rats + Sulphonamides.
Group 3: Induced rats + Standard drug (silymarin) that will be used to reverse the liver disease
Group 4: Induced rats + 100mg of the plant extract (*Mimosa pudica*) that will be used to reverse the liver disease
Group 5: Induced rats + 200mg of the plants extract (*Mimosa pudica*) that will be used to reverse the liver disease
Group 6: Induced rats + 300mg of plants extract (*Mimosa pudica*) that will be used to reverse the liver disease
Group 7: Rats + 100mg of the plants extract (*Mimosa pudica*) that will be used to reverse the liver disease

Population of the Study: A total of Forty-two (42) male wistar rats was used for the study. The animal was purchased from Lead City University Animal House. The plants were purchased from a farmland in Oyo-state was identify by Dr. Oloidi F.F. (department of Agricultural Economics and Extension, Ekiti State university).

Sample Size of the Study: A total of thirty-six (36) male wistar rats was used as the sample size. Six (6) was induced with sulphonamides, six (6) was induced with

sulphonamides and 100mg of the *Mimosa pudica* was given, six (6) was induced with sulphonamides and 200 mg of *Mimosa pudica* extract was administered, six (6) was induced with sulphonamides and 300 mg of *Mimosa pudica* extract was administered, six (6) was induced with sulphonamides and standard drug (silymarin) was administered, six (6) was given only 100 mg of *Mimosa pudica* extract.

Sampling Techniques: Liver function test parameters which are; Alkaline phosphatase (ALP), Total protein (TP), Alanine aminotransferase (ALT), Albumin, Bilirubin and Aspartate aminotransferase (AST).

Method of Data Analysis: The primary data that was derived from animal study are presented using mean and standard deviation and ANOVA tables with explicit narration underneath each table, representing the result derived from the experiment. The statistical software package that was considered for this study is SPSS. The Statistical Package for the Social Sciences (SPSS) was used.

RESULT

Table 1: Comparison of mean ± SD of liver function parameters between the persons in the seven groups.

Liver	Grp1 (n=6)	Grp2 (n=6)	Grp3 (n=6)	Grp4 (n=6)	Grp5 (n=6)	Grp6 (n=6)	Grp7 (n=6)	F-value	p-value
ALT	17.8±4.0	45.7±5.6	15.0±3.2	51.2±7.6	41.2±6.6	20.3±5.4	17.5±3.3	50.490	0.000*
AST	14.0±3.0	48.8±5.7	12.5±2.7	56.7±5.1	40.5±6.9	14.5±1.9	14.0±2.8	116.358	0.000*
TP	7.0±0.9	4.5±1.0	6.8±0.8	4.2±0.8	4.7±0.8	7.0±0.9	7.0±0.9	14.507	0.000*
Alb	3.9±0.3	2.7±0.7	3.7±0.3	2.7±0.5	3.0±0.9	4.0±0.5	3.9±0.7	5.315	0.001*
Glo	3.1±0.5	1.7±0.6	3.1±0.5	1.6±0.7	1.7±0.8	2.7±0.7	3.1±1.2	5.674	0.000*
ALP	15.8±3.8	40.5±5.9	15.7±2.9	46.2±3.6	35.3±3.6	17.5±3.8	16.5±3.6	67.163	0.000*
GGT	20.0±6.8	43.5±4.6	19.2±6.2	49.0±7.4	37.5±10.8	16.7±5.7	14.8±2.3	26.617	0.000*
AST/ALT	0.8±0.1	1.1±0.1	0.9±0.1	1.1±0.1	1.0±0.1	0.7±0.1	0.9±0.2	33.380	0.000*

* $p < 0.05$.

Table 2: Comparison of mean ± SD of liver function parameters in Group 1 (No inducement or treatment) with each of the six treatment groups.

Liver parameters	Group Number	Mean difference	p-value
ALT	Group 2	-27.83	0.000*
	Group 3	2.83	0.967
	Group 4	-33.33	0.000*
	Group 5	-23.33	0.000*
	Group 6	-2.50	0.982
	Group 7	0.33	0.982
AST	Group 2	-34.83	0.000*
	Group 3	1.50	0.997
	Group 4	-42.67	0.000*
	Group 5	-26.50	0.000*
	Group 6	-0.50	1.000
	Group 7	0.00	1.000
Total Protein	Group 2	2.50	0.000*
	Group 3	0.17	1.000
	Group 4	2.83	0.000*
	Group 5	2.33	0.001*
	Group 6	0.00	1.000
	Group 7	0.00	1.000
Albumin	Group 2	1.15	0.035*
	Group 3	0.13	1.000
	Group 4	1.13	0.039*
	Group 5	0.92	0.153
	Group 6	-0.08	1.000
	Group 7	0.00	1.000
Globulin	Group 2	1.40	0.039*
	Group 3	0.08	1.000
	Group 4	1.58	0.013*
	Group 5	1.47	0.027*
	Group 6	0.47	0.931
	Group 7	0.05	1.000
ALP	Group 2	-24.67	0.000*
	Group 3	0.17	1.000
	Group 4	-30.33	0.000*

	Group 5	-19.50	0.000*
	Group 6	-1.67	0.990
	Group 7	-0.67	1.000
GGT	Group 2	-23.50	0.000*
	Group 3	0.83	1.000
	Group 4	-29.00	0.000*
	Group 5	-17.50	0.001*
	Group 6	3.33	0.977
	Group 7	29.17	0.773
AST/ALT Ratio	Group 2	-0.28	0.000*
	Group 3	-0.05	0.853
	Group 4	-0.31	0.000*
	Group 5	-0.19	0.000*
	Group 6	0.09	0.246
	Group 7	0.02	1.000

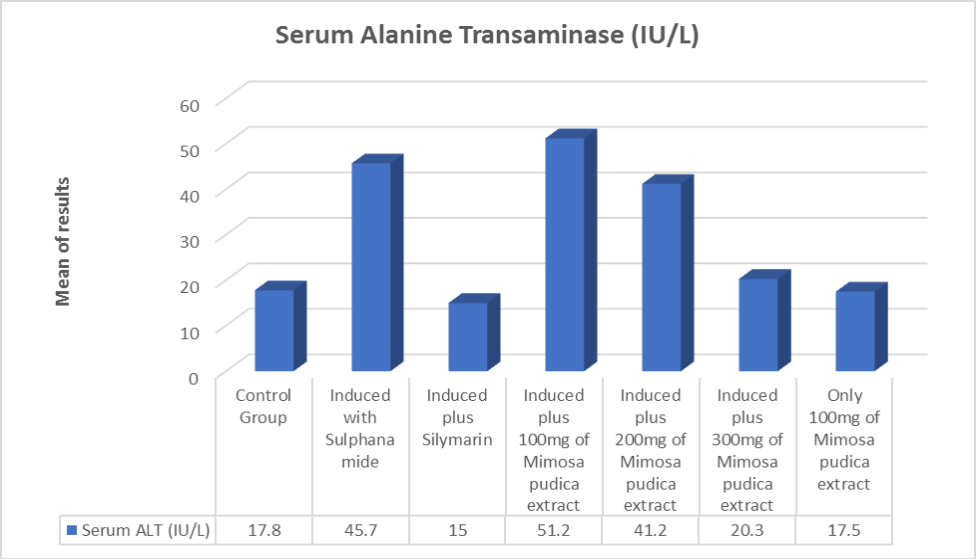

Figure 1: Effect of *Mimosa pudica on* Alanine aminotransferase levels of control and induced Wistar rats.
Results represented as Mean # SEM n=6. P<0.01.

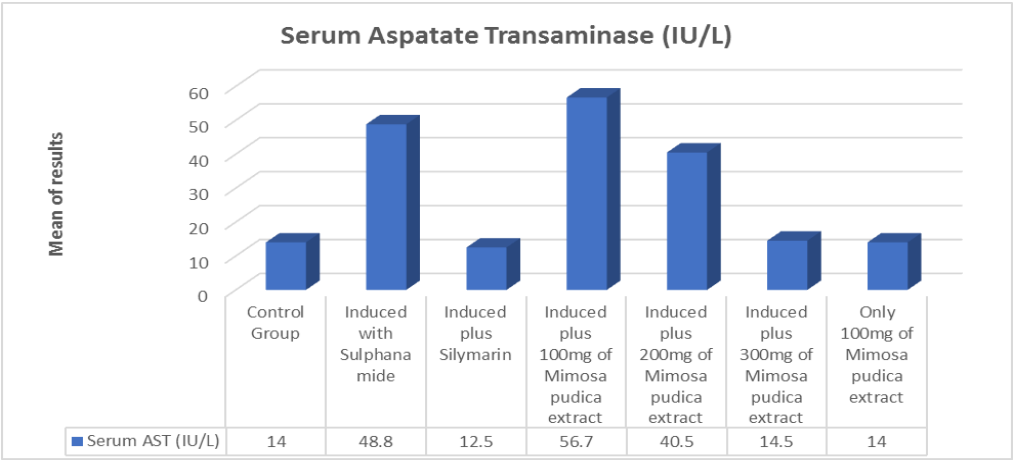

Figure 2: Effect of *Mimosa pudica on* Aspartate aminotransferase levels of control and induced Wistar rats.
Results represented as Mean # SEM n=6. P<0.01.

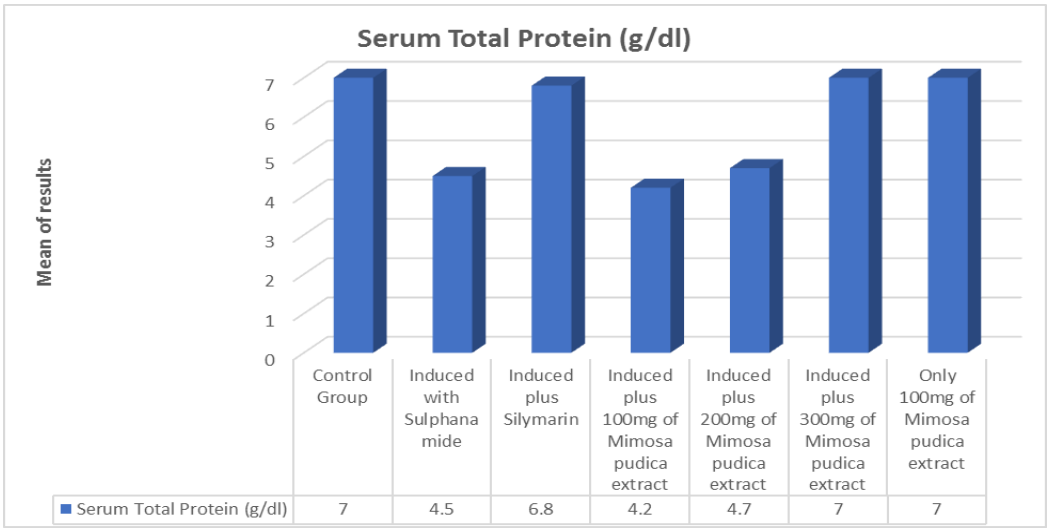

Figure 3: Effect of *Mimosa pudica on* Total Protein levels of control and induced Wistar rats.
Results represented as Mean # SEM n=6. P<0.01.

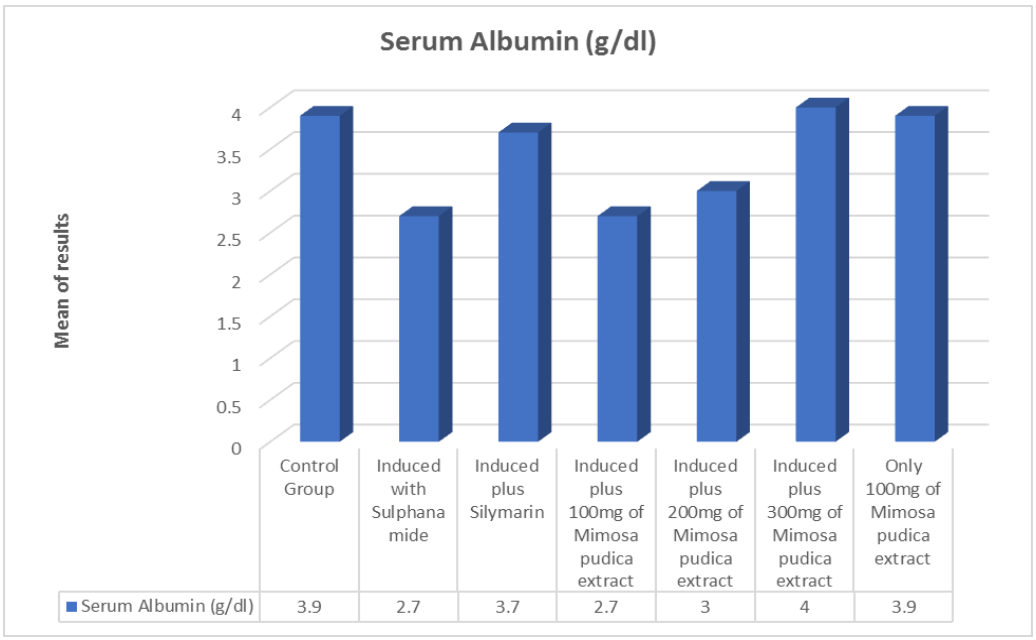

Figure 4: Effect of *Mimosa pudica* on Albumin levels of control and induced Wistar rats.
Results represented as Mean # SEM n=6. P<0.05.

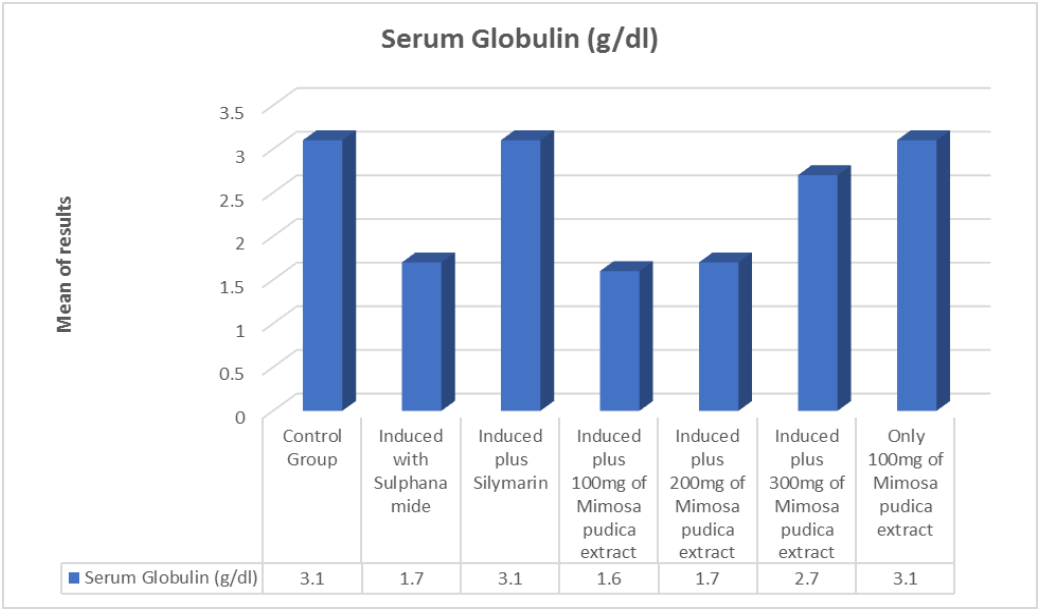

Figure 5: Effect of *Mimosa pudica* on Globulin levels of control and induced Wistar rats.
Results represented as Mean # SEM n=6. P<0.01.

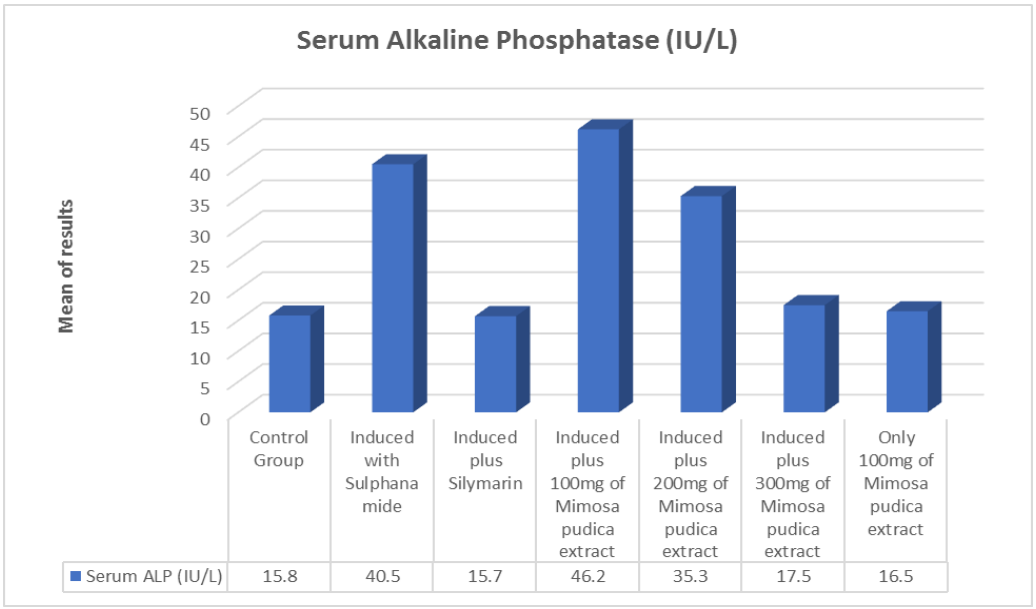

Figure 6: Effect of *Mimosa pudica* on Alkaline Phosphatase levels of control and induced Wistar rats.
Results represented as Mean # SEM n=6. P<0.01

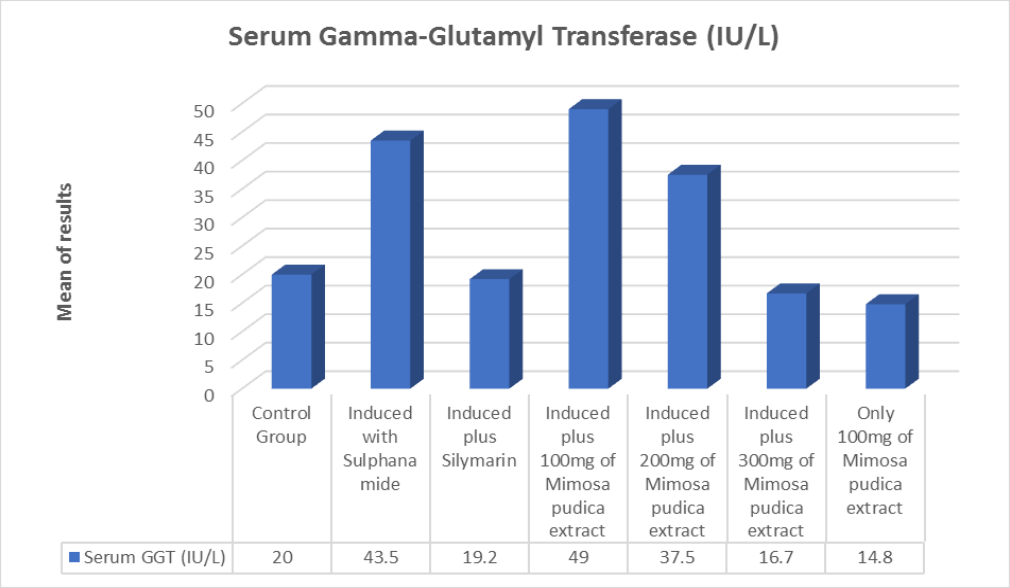

Figure 7: Effect of *Mimosa pudica* on Gamma-Glutamyl Transferase levels of control and induced Wistar rats.
Results represented as Mean # SEM n=6. P<0.01

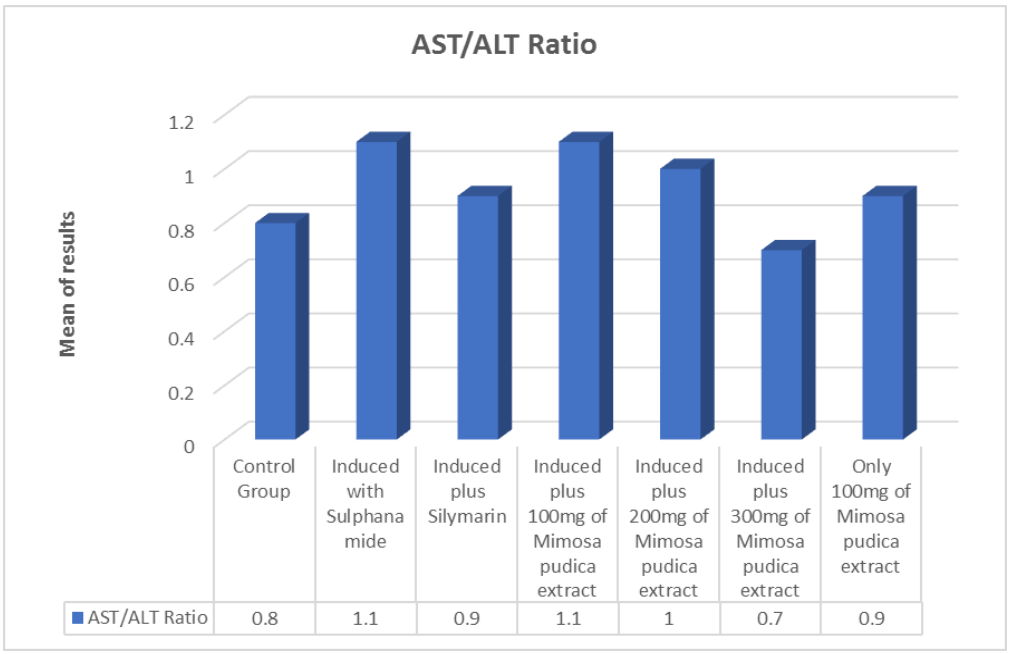

Figure 8: Effect of *Mimosa pudica* on AST/ALT ratio levels of control and induced Wistar rats.
Results represented as Mean # SEM n=6. P<0.01

DISCUSSION

In the present era, medicinal herb resources are abundant but these resources are dwindling fast due to the onward march of civilization (Haripyaree *et al*., 2010). Although a significant number of studies have been used to obtain purified plant chemical, very few screening programmes have been initiated on crude plant materials. This study is aimed to study the effect of *Mimosa pudica* in sulphanamide-induced liver disease in albino wistar rat. There were forty-two wistar rats distributed into seven different groups with different pattern of treatments: Group 1: Rats were fed water only; this is a negative control. Group 2: Rat fed with Sulphonamide (3000 mg) which is the positive control. Group 3: Sulphanamide (3000 mg) and Standard drug, silymarin (210 mg). Group 4: Sulphonamide (3000 mg) and 100 mg/kg of aqueous extract of *Mimosa pudica*. Group 5: Sulphonamide (3000 mg) and 200 mg/kg of aqueous extract of *Mimosa pudica*. Group 6: Sulphonamide (3000 mg) and 300 mg/kg of aqueous extract of *Mimosa pudica*. Group 7: Rats and 100 mg/kg of the aqueous extract of *Mimosa pudica*. The present study was carried out to investigate the biochemical effect of aqueous extract of *Mimosa pudica* leaf in sulphonamide-induced albino wistar rats by using liver marker enzymes. The biochemical assays that were analyzed are; Alanine aminotransferase, Aspartate aminotransferase, Total

Protein, Albumin, Globulin, Alkaline phosphatase, Gamma-glutamyl transferase and AST/ALT ratio.

Administration of sulphonamide caused an increase in the levels of ALT, AST, ALP, GGT and AST/ALT ratio which are considered as the selective biomarkers of liver function when compared with the normal control. From the results obtained, Sulphonamide in group two elevated ALT by 128%. However, 200 mg and 300 mg of the extract reduced ALT by 55.46% and 112.56% ($P < 0.01$) respectively. Sulphanamide in group three elevated AST very significantly by 174%. Interestingly, 200mg and 300mg of the extract reduced AST by 60% and 168.27% ($P < 0.01$) respectively. Sulphonamide in group seven elevated the GGT significantly by 108.75%. However, 200 mg of extract reduced GGT ($P < 0.01$) by 58% but 300 mg of extract elevated GGT by 130%. Sulphonamide in group six elevated ALP significantly by 128%. Interesting, 200 mg and 300 mg of the extract reduced ($P < 0.01$) ALP by 57% and 115.71% respectively. Elevated liver enzymes such as ALT, AST, GGT, ALP are often indications of inflammation or damage to the cells in the liver. Injured liver cells leak higher than normal amounts of certain chemicals, including liver enzymes, into the blood streams, thereby elevating the amount of liver enzymes on blood investigation. The sulfonamides are synthetic bacteriostatic antibiotics with a wide spectrum against most gram-positive and many gram-negative organisms. Sulfonamides inhibit multiplication of bacteria by acting as competitive inhibitors of *p*-aminobenzoic acid in the folic acid metabolism cycle. Basically, the liver is a detoxification organ for sulphanamide. At high doses, sulphanamide disrupt the cells of the human system especially that of the liver when it is overwhelmed (Lapointe-Shaw *et al.,* 2018). *Mimosa pudica* on the other hand is recognized as effective in the repairs of the liver morphology and preventing the spillage of liver enzymes into the blood stream as shown in the study. The findings is in agreement with Gandhiraja *et al*., (2009) who submitted that ethanolic extract of *Mimosa pudica* reversed liver-induced disease caused by carbon tetrachloride. Also, in accordance with Sule *et al*., (2017) who reported that the use of leaf extracts of *Mimosa pudica* is safe but intake of high doses and prolonged use may cause organ toxicity. The findings is further supported by Muhammad *et al.,* (2015) also agreed that *Mimosa pudica* extract serves as a hepatoprotective agent in reversing liver disease. This result agrees with Kumar *et al*, (2015) who reported that *Mimosa pudica* have a positive potential in reversing diseases. Sulphanamide in group four reduced Total Protein significantly by 32.14% but 200mg of the extract elevated Total Protein by 47.87% ($P < 0.01$) while 300mg had no significant effect. Sulphanamide in group 5 reduced Albumin significantly by 34.61%, however 200mg of the extract elevated Albumin by 45% ($P < 0.05$) but 300 mg of the extract has no significant effect. Also, Sulphanamide in group 6 reduced Globulin significantly by 27.42%. while 200 mg and 300 mg of the extract elevated Globulin by 50% and 31.48% ($P < 0.01$) respectively. The hepatoprotective ability of this plant *Mimosa pudica* is attributable to the presence of antioxidant constituents such as flavonoids and tannins might be responsible for the free radical scavenging and antioxidant activity of the *Mimosa pudica*, these have been responsible for its inhibitory activity. Sulphanamide in group eight elevated the AST/ALT ratio significantly by 68.75%. 200 mg of the extract reduced AST/ALT ratio by 58% and 300mg of the extract reduced ($P <0.01$) AST/ALT by 78.57%. An AST/ALT ratio of less than one (where the ALT is significantly higher than the AST) means there is possibility of non-alcoholic fatty liver disease. An AST/ALT ratio equal to one (where the ALT is equal to AST) may be a sign of drug related toxicity. In many forms of acute or chronic liver injury, the ratio is less than or equal to 1 (Kumaresan *et al.,* 2015). This could be due to Sulphonamide as in this study.

CONCLUSION

This study indicates the potential hepatoprotective effects of medicinal plants on various hepatotoxins induced liver disorder in animal models. Hepatoprotective activity of these medicinal plants can be attributed to the presence of various phytochemicals such as alkaloids, flavonoids, tannin, sterols, saponin, quercetin, glycosides and phenolic compounds. The significant relationship between liver enzymes and liver disease in this study was validated as shown by the biochemical parameters. *Mimosa pudica* has gained a reputation as a medicinal herb, strong antioxidant properties. The molecular basis, for the complete reversal of Liver damage in this study is highly recommended.

Conflict of Interest

The authors declare no conflicts of interest. The authors alone are responsible for the content and the writing of the paper.

Funding

This research did not receive any grant from funding agencies in the public, commercial, or not-for-profit sectors.

Authors' Contributions

The entire study procedure was conducted with the involvement of all authors.

ACKNOWLEDGEMENTS

The authors would like to acknowledge the management of Lead City University, Ibadan, Oyo State, Nigeria for creating the enabling environment for this study. Thanks to all the technical staff of St Kenny Research Consult, Ekpoma, Edo State, Nigeria for their excellent assistance and for providing medical writing/editorial support in accordance with Good Publication Practice (GPP3) guidelines.

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