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Hepatoprotective Effects of Aqueous Extract of Citrullus lanatus Seed on Alcohol-Induced Liver Toxicity in Wistar Rats

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Abstract: **Chronic alcohol consumption leads to oxidative stress and hepatic dysfunction. Natural antioxidants from plant sources such as *Citrullus lanatus* (watermelon) seeds may protect against such damage through free radical scavenging and membrane-stabilizing actions (Osna *et al*., 2017; Harjumäki *et al*., 2021). This study evaluated the hepatoprotective potential of aqueous extract of *Citrullus lanatus* seed (AECL) on alcohol-induced liver toxicity in Wistar rats. Thirty adult male Wistar rats (130–150 g) were divided into five groups (n = 6): Group I (normal control) received feed and water only; Group II (alcohol control) received 1 mL ethanol daily for 2 weeks; Group III (extract control) received AECL 500 mg/kg only; Group IV received ethanol + AECL 500 mg/kg; and Group V received ethanol + AECL 1000 mg/kg. Treatments were given orally for 6 weeks. Serum ALT, AST, ALP, and total protein were assayed. Data were analyzed using one-way ANOVA with LSD post-hoc test ($p \leq 0.05$). Alcohol exposure significantly increased ($p < 0.05$) ALT, AST, and ALP, while total protein decreased. Co-administration of AECL (500 mg/kg and 1000 mg/kg) significantly reversed these alterations toward normal. The higher dose produced effects comparable to control. Aqueous extract of *Citrullus lanatus* seed protects against alcohol-induced liver injury, likely via antioxidant and membrane-stabilizing mechanisms.**

Keywords: ***Citrullus lanatus*****, hepatotoxicity, ethanol, liver enzymes, antioxidant, Wistar rat.**

1. INTRODUCTION

Excessive alcohol intake promotes hepatic oxidative stress and inflammation, leading to cellular injury and metabolic imbalance (Osna *et al*., 2017). Ethanol metabolism in hepatocytes generates reactive oxygen species (ROS), which trigger lipid peroxidation and disrupt membrane integrity (Harjumäki *et al*., 2021).

The liver is central to detoxification and metabolism; hence, it is vulnerable to toxic insults. Elevations of liver enzymes such as alanine transaminase (ALT), aspartate transaminase (AST), and alkaline phosphatase (ALP) indicate hepatocellular damage, while reduced serum protein levels reflect impaired synthetic function (Aulbach and Amuzie, 2017).

Natural antioxidants are being explored for their protective roles in oxidative liver injury. *Citrullus lanatus* (watermelon) seed contains phenolics, flavonoids, saponins, and alkaloids that exhibit free radical scavenging and anti-inflammatory properties (Deshmukh, Jain and Tambe, 2015; Enemali *et al.*, 2020). This study assessed the hepatoprotective effects of aqueous *C. lanatus* seed extract in alcohol-treated rats.

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2. MATERIALS AND METHODS

Ethical Approval

Ethical approval for this study was obtained from the Animal Ethics Committee, Faculty of Basic Medical Sciences, Chukwuemeka Odumegwu Ojukwu University, Uli Campus. All experimental procedures involving Wistar rats were conducted in accordance with the guidelines of the National Institutes of Health (NIH Publication No. 85–23, 1985) for the care and use of laboratory animals.

Location of Study

The study was conducted in the Animal House, Department of Human Physiology, Faculty of Basic Medical Sciences, Chukwuemeka Odumegwu Ojukwu University, Uli Campus, Anambra State, Nigeria.

Materials

The materials used include *Citrullus lanatus* seeds, thirty (30) male Wistar rats, Randox reagent kits (England), Pyrex beakers (Techmel, USA), measuring cylinders (MINGHE), 2 mL hypodermic syringes, an electronic weighing balance (Mettler M311L, China), oral cannula, microscope slides, Olympus XSZ-107BN microscope, and Whatman qualitative filter paper No. 1 (Sigma Aldrich WHA1001042). Additional items included distilled water, standard plastic cages, cotton wool (KENS LINT, Benin City, Nigeria), latex hand gloves (Supermax Gloves, Selangor, Malaysia), chloroform (Guangdong Guandgua Chemical Factory Co. Ltd., Shatou, China), Vital Grower feed (Jos, Nigeria), dissecting kits, automatic water distiller (SZ-1 Search Tech Instrument), Nexus refrigerator, rotary evaporator (TT-52; Techmel & Techmel, USA), UV-VIS 752N spectrophotometer (Shanghai Yoke Instrument Co., Ltd., China), and thermostat oven (DHG-9023A, PEC MEDICAL, USA).

Extraction procedure

Fresh *Citrullus lanatus* (watermelon) seeds were obtained, washed thoroughly with clean water, and air-dried at room temperature to remove moisture. The dried seeds were ground into coarse powder using a local grinder. Exactly 250 g of the powdered seed was soaked in 1500 ml of lukewarm distilled water and macerated for 24 hours with intermittent shaking to enhance extraction. The mixture was first sieved using a clean muslin cloth and then filtered through Whatman No. 1 filter paper into a clean glass container. The filtrate obtained was concentrated using a rotary evaporator and further dried in a thermostat oven at 45°C to yield a gel-like extract. The final extract was stored in an airtight container and preserved in a refrigerator until required for experimental use.

Experimental design

The animals were randomly divided into five (5) groups of six rats each as follows:

Group A (Alcohol control): Received alcohol only.

Group B (Normal control): Received feed and distilled water only.

Group C (Extract control): Received 500 mg/kg of aqueous seed extract of *C. lanatus* (ASCL) only.

Group D (Low-dose treatment): Received alcohol for two weeks followed by 500 mg/kg ASCL for four weeks.

Group E (High-dose treatment): Received alcohol for two weeks followed by 1000 mg/kg ASCL for four weeks.

Alcohol administration was done orally using a cannula to induce renal toxicity. The aqueous seed extract of *Citrullus lanatus* was also administered orally using a cannula for the duration of the treatment. The entire experimental period lasted six (6) weeks.

Statistical analysis

Data obtained were analyzed using Statistical Package for Social Sciences (SPSS) version 25 (IBM, USA). Results were expressed as mean ± standard error of mean (SEM). Statistical differences between groups were determined using one-way analysis of variance (ANOVA) followed by Fisher's Least Significant Difference (LSD) post hoc test. Differences were considered statistically significant at $p \leq 0.05$.

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3. RESULTS

Relative Liver Weight

Alcohol exposure significantly ($p < 0.05$) increased relative liver weight compared to control. Treatment with AECL reduced this increase toward normal.

Liver Function Markers

Ethanol significantly elevated serum ALT, AST, and ALP, with a concurrent decrease in total protein. AECL administration at both doses normalized these markers, with the 1000 mg/kg dose giving near-control values.

Table 1: Effects of aqueous extract of *Citrullus lanatus* seed on body weight following alcohol induced toxicity

	Initial body weight (g/100g body weight)	Final body weight (g/100g body weight)	p-value	t-value
	MEAN±SEM	MEAN±SEM		
Group A (1 ml of Alcohol)	175.00±5.40	140.50±5.69	0.008*	6.222
Group B (control)	133.25±2.13	156.00±3.36	0.023*	-4.333
Group C (500 mg/kg of ASCL)	167.40±0.81	177.40±1.96	0.020*	-3.727
Group D (1 ml of Alcohol + 500 mg/kg of ASCL)	167.40±0.81	171.00±2.12	0.202#	-1.527
Group E (1 ml of Alcohol + 1000 mg/kg of ASCL)	147.20±1.24	177.80±1.39	0.000*	-16.948

Data were analyzed using paired t-test. Values were considered significant at $p \leq 0.05$. ASCL: aqueous seed extract of *Citrullus lanatus*, : significant, #: not significant when compared to group A.

Table 1 result showed a significant decrease in mean body weight in group A when compared to its initial weight ($p = 0.008$). Groups B, C, and E showed a significant increase in body weight ($p = 0.023$, $p = 0.020$, $p = 0.000$), while group D showed no significant difference ($p = 0.202$) but indicated an increasing trend when compared to group A.

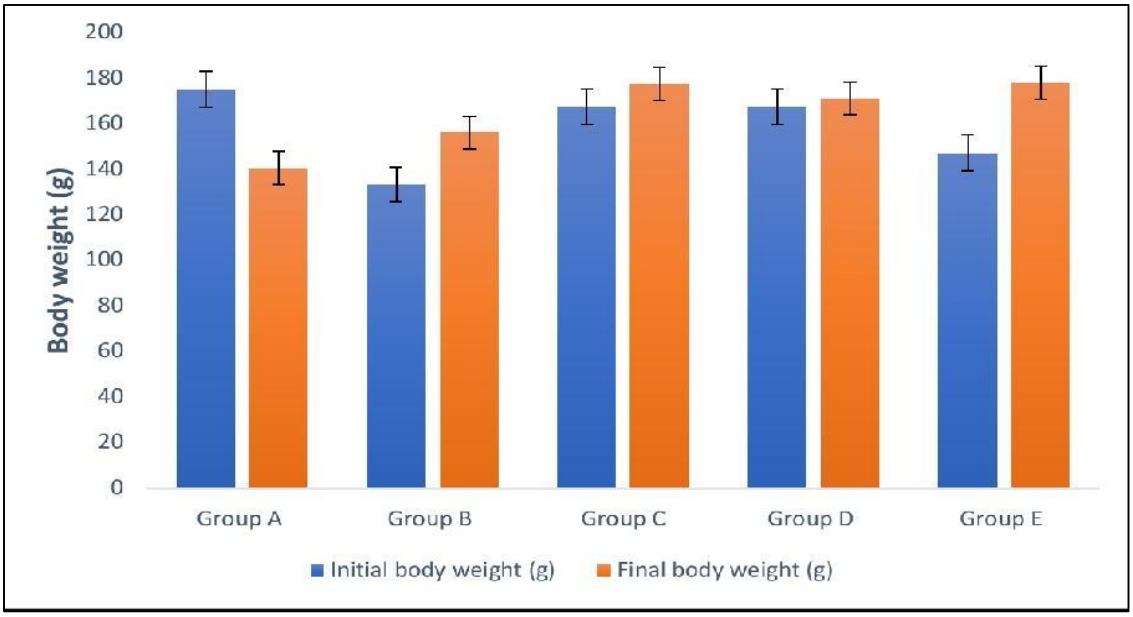

Fig 1: effects of aqueous extract of *Citrullus lanatus* seed on body weight following alcohol induced toxicity

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Table 2: Effects of aqueous extract of *Citrullus lanatus* seed on relative liver weight following alcohol-induced toxicity

	Relative liver weight (g)
Group A (1 ml of Alcohol)	4.31±0.18
Group B (control)	3.23±0.14*
Group C (500 mg/kg of ASCL)	3.12±0.09*
Group D (1 ml of Alcohol + 500 mg/kg of ASCL)	3.03±0.02*
Group E (1 ml of Alcohol + 1000 mg/kg of ASCL)	3.31±0.18*
P-value	0.000
F-value	14.185

Data were analyzed using ANOVA followed by post hoc LSD multiple comparison. Values were considered significant at $p \leq 0.05$. ASCL: aqueous seed extract of *Citrullus lanatus*, : significant, #: not significant when compared to group A.

Table 2 result showed a significant increase in relative liver weight in group A compared to group B ($p = 0.002$). Groups C, D, and E ($p = 0.001$, $p = 0.000$, $p = 0.003$) showed a significant decrease compared to group A. Similarly, relative kidney weight increased significantly in group A compared to group B ($p = 0.003$), while groups C, D, and E ($p = 0.001$, $p = 0.002$, $p = 0.001$) showed a significant decrease relative to group A.

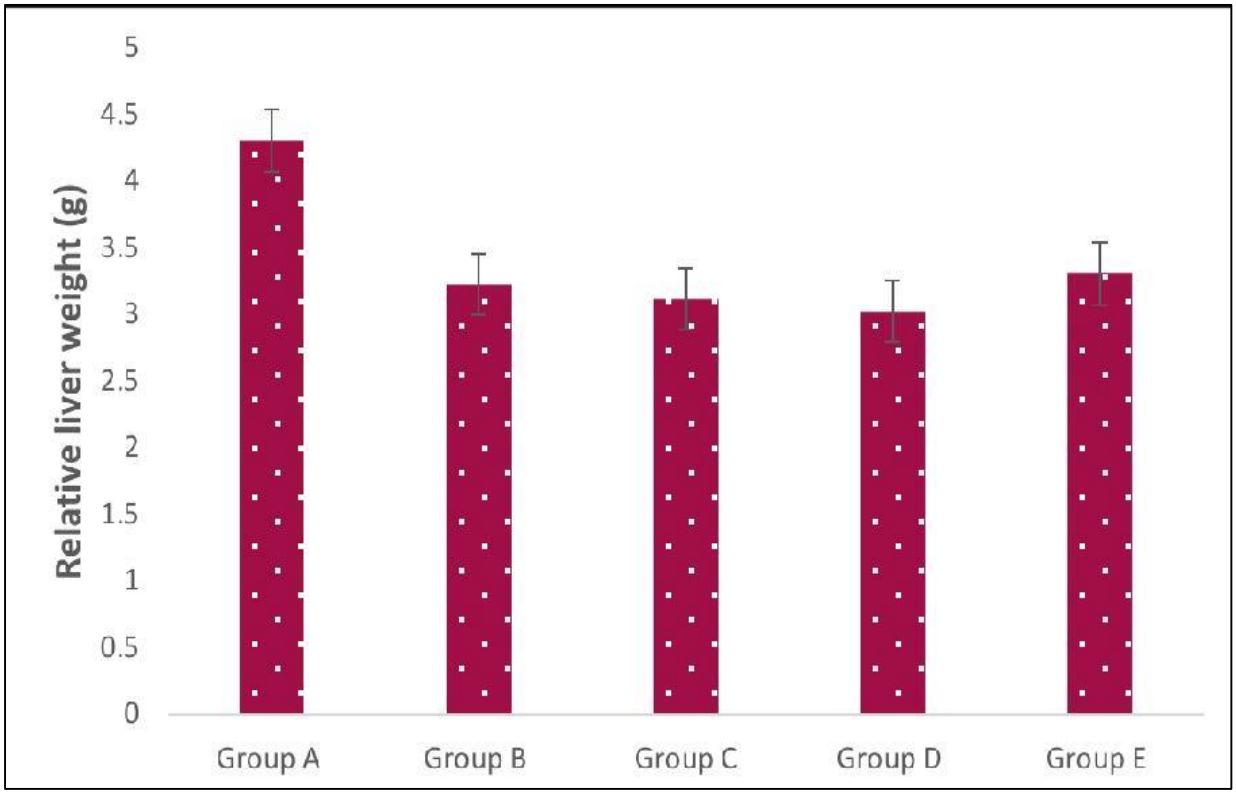

Fig 2: effect of aqueous extract of *Citrullus lanatus* seed on relative liver weight following alcohol-induced toxicity

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Table 3: Effects of aqueous extract of *Citrullus lanatus* seed on AST, ALT, ALP, and total protein levels following alcohol-induced toxicity

	AST level (U/L)	ALT level (U/L)	ALP level (U/L)	TP (mg/dl)
	MEAN±SEM	MEAN±SEM	MEAN±SEM	MEAN±SEM
Group A (1 ml of Alcohol)	113.00±4.16	50.33±4.25	128.96±9.78	71.69±2.18
Group B (control)	81.67±8.82*	34.00±1.73*	70.10±2.63*	63.32±1.20*
Group C (500 mg/kg of ASCL)	84.00±6.65*	33.00±2.52*	100.131±1.01*	60.16±1.41*
Group D (1 ml of Alcohol + 500 mg/kg of ASCL)	79.33±7.53*	38.67±2.33#	105.00±4.15*	57.80±2.52*
Group E (1 ml of Alcohol + 1000 mg/kg of ASCL)	86.67±6.06*	36.33±2.60*	103.31±3.82*	62.68±2.55*
P-value	0.033	0.009	0.003	0.007
F-value	4.043	6.153	8.596	6.561

Data were analyzed using ANOVA followed by post hoc LSD multiple comparison. Values were considered significant at $p \leq 0.05$. ASCL: aqueous seed extract of *Citrullus lanatus*, : significant, #: not significant when compared to group A.

Table 3 result showed a significant increase in AST levels in group A compared to B ($p = 0.009$), while groups C, D, and E ($p = 0.013$, $p = 0.006$, $p = 0.021$) showed significant decreases when compared to group A. ALT levels increased significantly in group A compared to B ($p = 0.014$); however, groups C and E ($p = 0.010$, $p = 0.035$) showed significant decreases, while group D ($p = 0.087$) was not significant but indicated a decrease. ALP levels were significantly higher in group A compared to B ($p = 0.001$); groups C, D, and E ($p = 0.017$, $p = 0.039$, $p = 0.030$) showed significant decreases relative to group A. Total protein levels were significantly elevated in group A compared to B ($p = 0.016$), while groups C, D, and E ($p = 0.003$, $p = 0.001$, $p = 0.011$) demonstrated significant decreases when compared to group A.

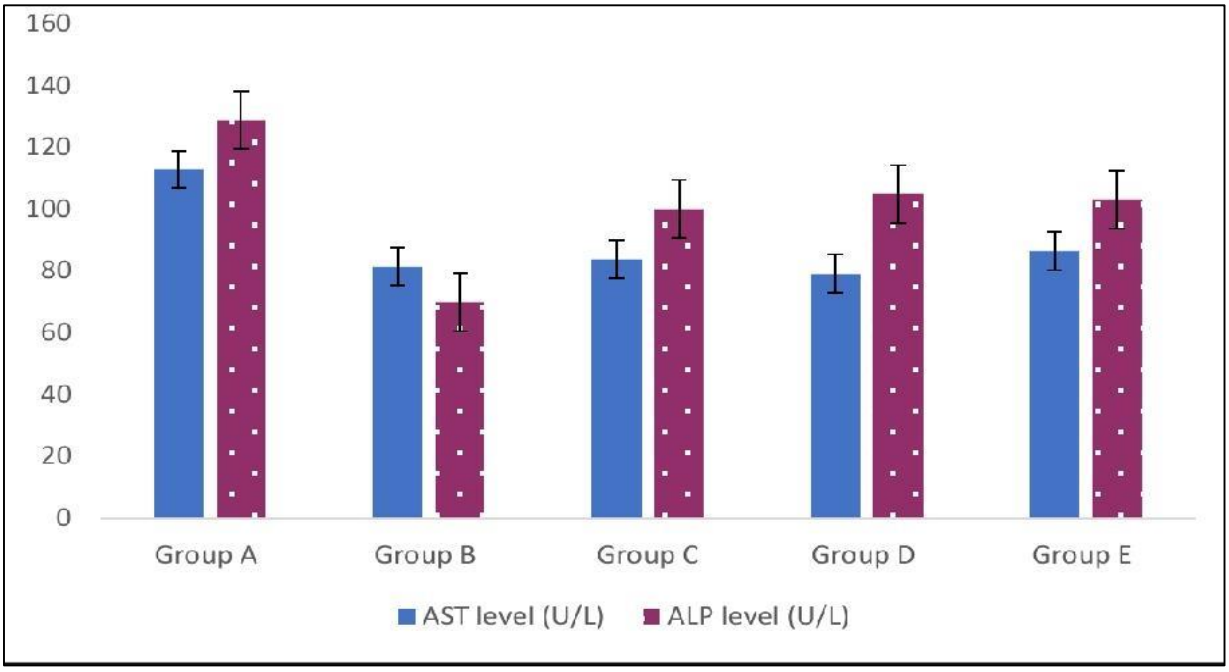

Fig 3: effect of aqueous extract of *Citrullus lanatus* seed on AST and ALP levels following alcohol-induced toxicity

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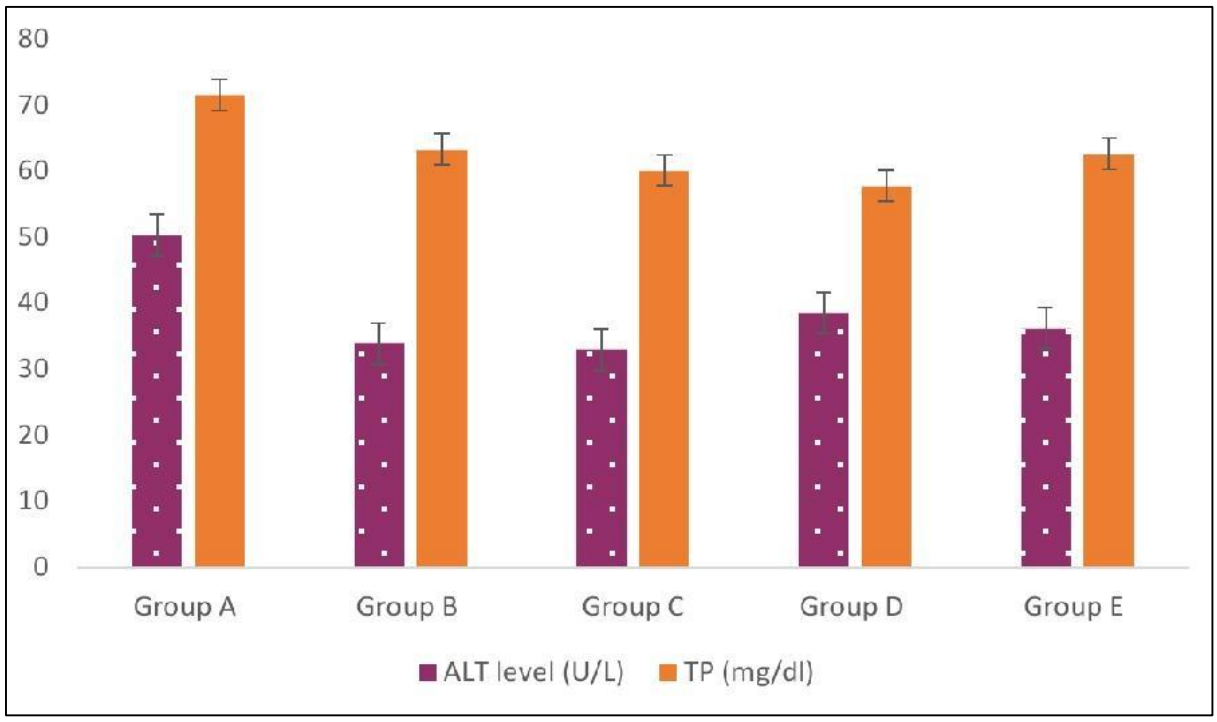

Fig 4: effect of aqueous extract of *Citrullus lanatus* seed on ALT and total protein levels following alcohol-induced toxicity

Table 4: Phytochemical Analysis of *Citrullus lanatus* seed

Phytochemicals	**Reference**
Phenols	++
Tannins	++
Flavonoids	+++
Glycosides	+
Saponins	+
Steroids	+

Phytochemical screening of the aqueous seed extract of *Citrullus lanatus* revealed the presence of phenols, tannins, flavonoids, glycosides, saponins, and steroids. Flavonoids were highly abundant (+++), followed by moderate levels of phenols and tannins (++), and mild presence of glycosides, saponins, and steroids (+). These findings are consistent with previous reports by Sathya and Shoba (2014; 2017).

4. DISCUSSION

Ethanol administration caused significant hepatic enzyme elevation, confirming liver damage due to oxidative stress and membrane leakage (Osna et al., 2017; Harjumäki et al., 2021). AECL significantly reduced these enzyme levels, suggesting stabilization of hepatocyte membranes and enhanced antioxidant defense. The normalization of total protein implies recovery of hepatic synthetic capacity. The observed protection may be attributed to the phytochemicals in *C. lanatus* seed, particularly flavonoids and phenolic compounds, which neutralize ROS and prevent lipid peroxidation (Deshmukh, Jain and Tambe, 2015; Enemali *et al.*, 2020; Omotoso, 2018). These findings agree with previous reports demonstrating hepatoprotective properties of C. lanatus in chemically-induced liver injury (Omotoso, 2018; Ullah *et al.*, 2020). The dose-dependent response observed here indicates stronger protection at higher extract concentrations.

5. CONCLUSION

Aqueous extract of *Citrullus lanatus* seed confers significant protection against ethanol-induced hepatotoxicity by normalizing liver enzyme activity and restoring protein synthesis. Its action is attributed to its antioxidant phytochemical constituents.

6. RECOMMENDATIONS

Isolation of the active antioxidant components and molecular studies are recommended to further define the protective mechanisms of *Citrullus lanatus* seed extract.

REFERENCES

[1] Aulbach, A.D. and Amuzie, C.J. (2017) 'Hepatic biomarkers of toxicity', Toxicologic Pathology, 45(8), pp. 1174–1188.

[2] Deshmukh, C.D., Jain, A. and Tambe, M.S. (2015) 'Pharmacological potential of *Citrullus lanatus*: A review', Journal of Pharmacy Research, 9(2), pp. 77–81.

[3] Enemali, M.O., Anekwe, G.E., Nwobodo, E.D. and Orji, C.O. (2020) 'Hepatoprotective activity of *Citrullus lanatus* seed extract against acetaminophen-induced liver damage in rats', Journal of Applied Sciences and Environmental Management, 24(2), pp. 219–224.

[4] Harjumäki, R., Kankaanpää, M., Savolainen, M.J. and Hannuksela, M.L. (2021) 'Alcohol metabolism and oxidative stress', Frontiers in Physiology, 12, 748.

[5] Omotoso, O.D. (2018) 'Regenerative effects of watermelon seed extract on paracetamol-induced hepatotoxicity in rats', African Journal of Biochemistry Research, 12(3), pp. 35–42.

[6] Osna, N.A., Kharbanda, K.K. and Tuma, D.J. (2017) 'Alcoholic liver disease: Pathogenesis and management', Nature Reviews Gastroenterology & Hepatology, 14(1), pp. 45–59.

[7] Ullah, R., Khan, M.A., Shah, S.A. and Rahman, S.U. (2020) 'Phytochemistry and therapeutic potential of watermelon (*Citrullus lanatus*)', Pharmacognosy Reviews, 14(27), pp. 49–56.