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An Assessment of Hepatoprotective Activity of *Aloe barbadensis* on Rat Model with Safety Profile Analysis

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The art of employing herbs and herbal medications to preserve health and prevent, is an ancient practice. To continue the legacy we selected *Aloe barbadensis* extract to assess its lipid lowering effect on rat model. Here, it has been observed that Groups 5 and 6 showed statistically significant results ($P<0.05$) in the renal function test. Groups 4 and 5 exhibited significant levels of creatinine. When considering the SGPT and SGOT, it was seen that the SGOT levels in groups 5 and 6 were statistically significant ($P<0.05$). On the other hand, the SGOT levels were found to be significant in groups 6 and 7. In the instance of the lipid profile test, the outcome was found to be statistically significant ($P<0.05$) in groups 4, 5, and 6 for the total cholesterol level. In the case of triglyceride levels, however, there is no result that can be considered statistically significant. In the case of groups 5 and 6, the HDL level exhibited statistically significant ($P<0.05$) outcomes, but the LDL level showed statistically significant results in the case of group 6.

Keywords: Aloe barbadensis; SGPT; herbal medicine; triglyceride, phytopharmacology; cholesterol.

1. INTRODUCTION

Among the human organs, the largest glandular organ, the liver, is responsible for the most functions. The whole blood supply of a person passes through the liver many times a day. Human metabolism relies heavily on the liver [1]. The most common kind of liver disease, known as hepatotoxicity, is caused by medicines and ranks high among animal and human causes of mortality and disability. [2]. Liver cells are especially vulnerable to damage from things like drug and alcohol misuse, toxic chemicals, viral or parasite infections, and elevated levels of reactive oxygen species (ROS) (OH, H_2O_2, O_2) [2]. People take ascorbic acid and the tripeptide L-glutathione (L-cysteine, glycine, and L-glutamate) orally as a dietary supplement because they can neutralize free radicals. Many people value them for their anti-oxidant, cleaning, and immune-boosting properties [3]. As an alternative, they might cause allergic reactions, including dermatitis, and gastrointestinal problems like bloating, diarrhea, stomach pains, and difficulty breathing owing to airway constriction. Chronic liver disease (CLD) affects 1.5 billion people globally; in the United States, the incidence has increased by 31% in the last several years among adults aged 45 to 64 years [4]. There may be therapeutic applications for some chemical components obtained from medicinal plants, according to experts in the field. Thus, scientists are continuously seeking out novel plant-based medicines, such as herbal remedies, to treat a broad variety of diseases [5]. Herbalism focuses on the practical use of therapeutic herbs, as opposed to phytotherapy, which is centered on scientific research. The vast variety of compounds found in plants, many of which have therapeutic properties, has made them an important part of human medicine for thousands of years [6]. Medicinal plants have a wide range of pharmacological and therapeutic effects due to the abundance of chemical components they contain. Some examples of these components include tannins, glycosides, alkaloids, saponins, polysaccharides, essential oils, terpenoids, resins, and plant lipids [7–9]. Plant genetic modification can achieve the targeted therapeutic impact by adjusting the amounts of chemical components. Improving the manufacture of secondary metabolites, such as alkaloids, is one use of reverse genetics [10].

One member of the Liliaceae family is the evergreen succulent Aloe vera (*A. barbadensis*). "Young lady" is the literal translation of Aloe vera's Sanskrit name, Kumari. Directing the flow of menstruation is a common use of aloe. It balances the monthly cycle-controlling Apana Vata, according to Ayurveda. Many more areas, including Mexico, nations around the Pacific Rim, South America, Central America, and the Caribbean. Its many medicinal and economic uses have led to its global cultivation. On a global scale, several species are farmed for significant economic gain. Indian states such as Rajasthan, Haryana, Punjab, Andhra Pradesh, Gujarat, Maharashtra, and Tamil Nadu are home to this species [11]. Polyphenol, glycoside, alkaloids, terpenoids, tritrpenoids, phlobatannins, saponin, flavonoids, steroids, carbohydrate, and anthroquinone are all present [12,13]. It has a wide range of pharmacological effects. Research has shown that this molecule has a variety of beneficial effects, including antibacterial, antidiabetic, cytotoxic, cardioprotective, bone protective, anti-inflammatory, skin protective, hepatoprotective, and neuroprotective properties [14,15].

Our current research aims to assess *Aloe barbadensis*'s hepatoprotective effects.

2. MATERIALS AND METHODS

2.1 Plant Collection and Extract Preparation

*Aloe barbadensi.*were collected from local market of Dhaka. The material was authenticated by the University of Dhaka's Department of Pharmacy. *Aloe barbadensis* was air-dried and severely crushed. The powder was then extracted for 15 days in 50% ethanol. The extract was filtered at three-day intervals. The extracted material was dried in a rotary evaporator at a low temperature and pressure. Finally, the crude residue was subjected to the required pharmacological testing.

2.2 Drugs and Chemicals

Carbon tetrachloride (CCl_4), a well-known hepatotoxicity causing chemical, was purchased from the Sigma firm in the United States. The typical anti-oxidant medication silymarin was purchased as Livasil 140 mg from Incepta Pharmaceuticals Ltd.

2.3 Experimental Animal Procurement, Nursing, and Grouping

A total of 100 male rats weighing between 120and 150 grams were obtained from Jahangirnagar University in Savar, Dhaka. Each of them was housed in a climate-controlled environment (temperature 25±3°C, relative humidity 55±5%, and a 12-h light/dark cycle) at the University of Dhaka's Institute of Nutrition& Food Science (INFS). They were given a conventional food and were permitted to drink clean water. All of the animals were maintained in this habitat for at least one week prior to the research for adaption. All experimental methods followed the recommendations of the Institutional Animals Ethics Committee (IEAC).

2.4 Animal Model Sample Size Detection

There were 100 rats in all, and they were randomly divided into ten groups of ten. In every study, the rats were randomly allocated to one of the groups. To make sure the study was genuine, we utilized 10 rats per group. Conversely, we watched the rat closely each day while it was mating. The study's control groups were both positive and negative.

2.5 Dose Selection and Route of Administration for Respective Study

Carbon tetrachloride (CCL^4) is a common chemical agent used in laboratories to study arrange of liver diseases, both acute and chronic.Trichloromethyl free radical (CCL_3), a CYP2E1isozyme-produced CCL4 metabolite, reacts withcellular lipids and proteins to form trichloromethylperoxy radical, which attacks lipids on the endoplasmic reticulum membrane faster than thetrichloromethyl free radical, causing lipidperoxidation and lobular necrosis. A single oral treatment of CCl_4 mixed with olive oil as a vehicle in a 1:1 ratio (3 ml/kg of rat body weight) produced hepatic damage in all animal groups except the usual control group. *Aloe barbadensis* extracts were administered to animals with hepatic injury as a post-treatment. The extract was administered orally in various quantities.

2.6 Evaluation of Hepato–Protective Activity

For this experiment, 100 rats were randomly picked and equally divided into ten groups.

Table 1. Application of treatment efficacy

Group number	Group specification	Treatment species	Dose treatment species (mg/kg)	Abbreviation of groups
1	Negative Control	Physiological saline	10 ml/kg	N
2	CCl_4 Control	N/A	N/A	A
3	CCl_4 + S_{10}	Silymarin	10	S_{10}
4	CCl_4 + AB_{200}	*Aloe barbadensis*	200	AB_{200}
5	CCl_4 + AB_{400}	*Aloe barbadensis*	400	AB_{400}
6	CCl_4+AB_{600}	*Aloe barbadensis*	600	AB_{600}
7	S_{10}	Silymarin	10	S_{10}
8	AB_{200}	*Aloe barbadensis*	200	AB_{200}
9	AB_{400}	*Aloe barbadensis*	400	AB_{400}
10	AB_{600}	*Aloe barbadensis*	600	AB_{600}

Table 2. Lipid profile function test result

Group no.	Group status	Kidney function test		Liver function test		Lipid profile function test			
		Creatinine (mg/dl)	Urea	SGOT (u/l)	SGPT (u/l)	Cholesterol (mg/dl)	Triglyceride mg/dl)	LDL (mg/dl)	HDL (mg/dl)
1	Negative Control	0.5±0.04	26.52±3.41	35.24±0.82	35.24±0.82	96.32±4.19	45.35±2.63	38.25±3.91	69.26±4.33
2	CCl_4 Control	2.8±0.07	94.59±5.52	104.59±3.91	98.24±5.27	152.49±6.22	106.79±5.58	89.57±3.20	43.46±2.39
3	CCl_4 + S_{10}	1.4±0.06	42.63±4.53	72.72±3.29	70.29±4.19	109.42±5.82	58.67±4.23	60.54±4.11	57.49±3.24
4	CCl_4 + AB_{200}	2.3±0.05*	91.69±4.50	100.42±2.68	96.59±4.80	141.39±6.49*	102.31±3.17	89.19±4.53	46.48±1.26
5	CCl_4 + AB_{400}	1.9±0.05*	87.23±4.39*	96.58±4.79*	92.51±3.24*	137.25±3.26*	96.56±4,91	87.39±3.18	50.24±2.49*
6	CCl_4+AB_{600}	1.6±0.07	84.25±5.26*	91.79±2.29*	88.57±2.08*	132.55±4.50*	90.23±2.87	84.61±3.22*	53.19±3.16*
7	S_{10}	0.7±0.01	27.30±4.19	44.39±2.45	36.28±1.83	97.20±5.40	42.66±1.92	39.91±4.02	69.17±3.19
8	AB_{200}	0.6±0.02	28.24±3.14	42.43±3.39	38.91±2.53	93.28±4.50	44.05±0.87	42.45±2.39	71.26±2.18
9	AB_{400}	0.09±0.07	30.26±0.89	45.39±2.93	34.91±3.29	100.59±3.26	46.29±1.56	35.63±1.92	72.40±3.19
10	AB_{600}	0.08±0.03	26.82±1.57	44.50±1.26	34.56±2.21	96.59±2.49	44.18±2.36	40.49±2.37	68.46±2.20

*Note: Each value represents the mean ± SEM. (n=5). One- way ANOVA followed byDunnett's t test. ***P<0.001, **P<0.01, *P<0.05 compared with control*

2.7 Biological Sample Collection

We punctured a rat's tail to obtain blood samples for measuring blood glucose levels. On the other hand, blood was drawn from the animal as soon as its heart was punctured and transferred to a microcentrifuge tube after the killing. The samples were centrifuged at 5,000 rpm for 5 minutes to create the supernatant fluid. Biochemical testing subsequently required the transfer of this fluid to an additional microcentrifuge tube. We carefully took the kidney and liver from the animal after sacrifice and cleaned them in ice-cold saline to assess their function.

2.8 Estimation of Biochemical Parameters

The blood glucose level was measured using a glucometer. Aside from the Humaluzer 3000, lipid profile, kidney, and liver function tests were performed. In addition, the gluconeogenic and glycolytic enzyme activity of kidney and liver samples was examined.

2.9 Statistical Analysis

All of our findings (raw data) in terms of numerical parameters were recorded and analyzed on a broadsheet using the MS Excel application. The gathered data were subjected to descriptive statistics, with the findings reported as mean SD. To evaluate statistical significance, we used the SPSS 16 software's "One-way ANOVA test" to interpret inter-group heterogenicity in terms of several biological factors. The occurrences are considered statistically significant since the 'p' value was less than 0.05 ($p<0.5$).

3. RESULTS AND DISCUSSION

Both end-stage renal disease (ESRD) and severe chronic kidney disease (CKD) are medical conditions that may lead to cognitive impairment. The link between chronic kidney disease (CKD) and cognitive impairment is a significant problem that the public health community must address [16]. The prevalence of chronic kidney disease (CKD) in the United States went from 10% in the years 1988–1994, to 13% in the years 1999–2004, and it is possible that this trend may continue in the years to come. There was a statistically significant difference in the levels of creatinine between groups 4 and 5, whereas the findings of the kidney function test were statistically significant between groups 5 and 6. There were many studies that came up with the same results [17,18]. There was a statistically significant relationship between the SGPT and SGOT levels; however, only the SGOT levels were significant for groups 6 and 7, in comparison to the SGPT levels. The findings of several studies [19–21] were consistent with one another. According to the findings of the lipid panel test, groups 4, 5, and 6 exhibited values that were statistically significant for total cholesterol levels. On the other hand, when it comes to triglyceride levels, there is no statistically significant influence of this kind. Researchers found statistically significant levels of HDL in groups 5 and 6, while case 6 showed statistically significant levels of LDL. In a number of studies [22–24], researchers came to the same results.

4. CONCLUSION

The results of this experiment revealed that the ethanolic extract of *Aloe barbadensis* had hepatoprotective effects. The hepatoprotective effects of the ethanolic extract of *Aloe barbadensis* were determined over the course of the experiment. By lowering the buildup of lipids and liver problems, this extract helps to reduce the negative effects that a diet high in fat may have on the body. In order to determine which component of the entire extract really provides the anti-hyperlipidemic action through a screening approach, more research is necessary.

CONSENT

It is not applicable.

ETHICAL APPROVAL

Animal Ethic committee approval has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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