Journal of Chemical Health Risks

www.jchr.org

JCHR (2023) 13(06), 884-894 | ISSN: 2251-6727

Evaluation of Hepatoprotective, Antioxidant Activity and Cardioprotective Effects of Whole Parts of *Quisqualis Indica* in Rats

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(Received: 07 October 2023 Revised: 12 November Accepted: 06 December)

KEYWORDS
Quisqualis indicia, Antioxidant, Carbon tetra chloride, Paracetamol, Doxorubicin.

ABSTRACT:
To assess the ethanolic extract of Quisqualis indica leaves' hepatoprotective, antioxidant, and cardioprotective properties against CCl4 and paracetamol-induced hepatotoxicity as well as doxorubicin-induced cardiotoxicity in an experimental rat paradigm. For two reasons, the liver could be regarded as the most significant organ in terms of drug toxicity: It is a primary site of metabolism and the removal of foreign substances, and it serves as a functional barrier between the site of absorption and the enzymatic circulation. On the other hand, these characteristics also make it a desirable location for drug toxicity. The liver is the largest organ and is particularly vulnerable to toxicity due to its function in the detoxification process, which involves the removal and metabolism of substances. The powdered leaves in this study were extracted using pet ether and ethanol, and the resulting ethanolic extract was tested for acute toxicity using a dosage of up to 2000 mg/kg in accordance with OECD guidelines 425. Rats were used to test the extract's hepatoprotective and antioxidant properties against CCl4- and paracetamol-induced hepatotoxicity. Antioxidant parameter (SOD) and hepatoprotective biochemical indicators (ALT, AST, and ALP) were assessed. The extract's cardioprotective properties were investigated in relation to doxorubicin-induced cardiotoxicity, and cardiac biomarkers (LDH, CK-MB) and lipid profile parameters (TC, TG, HDL, and LDL) were examined. At 200 and 400 mg/kg, the extract dramatically boosted the activity of antioxidant enzymes. When comparing the induce group to the normal group, the levels of ALT, ALP, and AST also dropped. Additionally, it keeps animals from losing weight. Before receiving the Quisqualis indica extract, there was a decrease in the blood lipid profile and an increase in HDL cholesterol. Elevated levels of marker enzymes such CK-

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JCHR (2023) 13(06), 884-894 | ISSN: 2251-6727

MB and LDH in rats indicating doxorubicin-induced heart tissue damage. The current investigation discovered that the doxorubicin-induced release of LDH and CK-MB from rats' serum was inhibited by quisqualis indica extract. Based on the aforementioned results, it was determined that in a validated animal model, Quisqualis indica ethanolic extract had hepatoprotective, antioxidant, and cardioprotective properties.

1. INTRODUCTION

One of the few organs in the body that is as important as the liver is. In addition to its role in the regulation of a variety of physiological processes, its action is linked to a number of key activities, including as the metabolism, the secretion, and the storage of substances. Numerous researchers have been studying its capacity to synthesise beneficial agents and detoxify endogenous (waste metabolites) and exogenous (toxic chemicals) compounds of organisms [1-4]. This research has been going on since the 1970s.

The liver is involved in all of the biochemical processes that are involved in reproduction, development, nutrition, and the creation of energy. Moreover, it assists in the secretion of bile, the storage of vitamins, the metabolism of glucose and lipids, and other processes [5].

All of these factors contribute to the fact that hepatic diseases are a worldwide issue and one of the most significant threats to public health in the modern era [4,6]. When referring to any condition that affects the liver, whether it be cellular, structural, or functional damage, the phrase "hepatic disease" is used to describe the condition. A wide range of biological and autoimmune causes, such as bacteria, viruses, and parasites, are capable of causing this kind of damage. The activity of a number of different chemicals, such as some medicines, poisonous compounds, and excessive consumption of alcohol, can also be a contributor to the development of this condition. In spite of the significant advancements that have been made in modern medicine, there is still no treatment that has been able to completely maintain the liver, improve hepatic function, or assist in the regeneration of hepatic cells [10]. In addition, certain drugs have the potential to induce any number of undesirable side effects. Consequently, it is essential to discover new pharmaceuticals for the treatment of liver diseases, ideally ones that are less hazardous and deliver better results. Ischemic heart disease (IHD) is the leading cause of chronic disability and premature death on a global scale. It is also responsible for the majority of the health loss that is attributed to cardiovascular diseases (CVDs). An acute necrotic state of the myocardium that occurs as a result of a mismatch between the demand of the myocardium and the supply of blood to the coronary arteries is referred to as myocardial infarction (MI), also known as a heart attack [1]. An analysis of the antioxidant capacity of extracts derived from the leaves, stems, roots, and flowers of Quisqualis indica Linn. was carried out in order to establish the plant's ethnopharmacological relevance. In order to obtain the crude extracts, we utilised a variety of solvents, including n-hexane, chloroform, ethanol, and distilled water, among our polar and non-polar solvents. It was found that the chloroform extract of leaves had the highest percentage yield, which was 27.3%, while the n-hexane extract of stems had the lowest percentage yield, which was 0.2%. The DPPH free radical scavenging activity, the ABTS+ assay, the Total flavonoid components (TFC), the Total phenolic components (TPC), and the Metal chelating assay (MC) were the five activities that we utilised in order to determine the antioxidant activity of the plant. In the ethanol extract of the plant's inflorescence, the DPPH potential was found to be 452.11%, which was the highest value observed. It was discovered that the water-based extract of the root had the highest TEAC value, which was 7.4515 mmol. The flower aqueous extract had the highest content of phenolic components when it was evaluated at a concentration of 35 GAE mg/mL. However, the aqueous floral extract revealed a high concentration of flavonoids, with a value of 347.65 mg/l of quercetin. On the other hand, the chloroform extract had the highest bound iron value, which was 128. There is a widespread belief that all parts of the Quisqualis indica L. plant has antioxidant capabilities. The wide range of antioxidant potentials that they possess makes them suitable for use as medicines in both human and animal medicine. If it causes inflammation within the artery wall, coronary atherosclerosis might be a contributing factor in the development of

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myocardial infarction (MI). Injuries that are brought on by myocardial infarction (MI) are strongly dependent on reactive oxygen species (ROS), in addition to systems that mediate coronary artery obstruction and supply-demand mismatch [2]. Concerns that still need to be addressed include the rebound phenomenon, the high expense of maintenance that lasts a lifetime, and the likelihood of substantial adverse consequences that are associated with the effectiveness of traditional therapy in treating cardiovascular diseases.

Fig: 1 Quisqualis Indica Linn

2. MATERIAL & METHODS

Identification of Plants

The identification of Quisqualis Indica Linn. as a therapeutic plant was confirmed with the assistance of Prof. Tahira Israr, director of the Botany Department at ICAR's Pusa Campus in New Delhi.

Drying and Grinding of the Plant

After being washed thoroughly, the plants that were harvested were then roughly chopped using instruments such as shears and knives. It was decided to move them to a cool and shaded location in order to hasten the drying process and protect them from dust and other airborne pollutants. While the material was drying in a chamber that was absolutely dark, approximately three weeks elapsed. In order to achieve the most effective extraction process, it is necessary to obtain a powder of uniform size once the plants have been allowed to completely dry out. Additionally, the surface area should be maximised.

Experimental Rodents

For the purpose of the study, adult Wistar rats of both sexes that were cleansed and pale and weighed between 150 and 250 grammes were utilised. The animal was housed in polypropylene confines, with three pens for each animal, at a temperature of 28±5 degrees Celsius and a light/dull cycle that lasted for twelve hours. Chow pellets made by Hindustan Lever were utilised to feed the animal, and water was not provided as a basic diet. Before the experimentation, the animals were kept fasting for a period of time that was somewhere between short and long-term, and the Institutional Animal Ethics Committee gave their approval to every single procedure that was used in these evaluations.

Drugs and Chemicals

Carban tertrachloride was obtained from Sigma Aldrich in Bangalore, India, or Paracetamol from Dr. Reddy's Laboratory in Hyderabad, India. Silymarin and doxorubicin were purchased from Akums Drugs and Pharmaceuticals in Delhi, India. Various solvents were evaluated based on their logical evaluation.

DPPH Assay

In order to investigate the radical scavenging activities of the extracts, a spectrophotometric experiment was conducted using an alcoholic solution of 1,1-diphenyl-2-picrylhydrazyl (DPPH). The results of this experiment were described in [7]. It is important to note that the following procedures are carried out: Initial steps involve combining extracts-DMSO solutions ranging from 15.6-250 g/mL with a 200 mM DPPH solution that is dissolved in 100% ethanol. In the subsequent step, the mixture is placed in a dark incubator that is set to 25.1 degrees Celsius for a period of thirty minutes. Spectrophotometric measurements were

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collected at 517 nm once the incubation period was complete in order to make a comparison between each sample and a reference solution that was composed of DPPH and DMSO solutions. The purpose of this examination was to determine the degree to which the chrometric state of DPPH shifted from purple to yellow following the removal of the substance. During the course of this particular research project, ascorbic acid was regarded as the gold standard. The potential of the extracts to scavenge free radicals was measured as a proportion of the radical decrease that was observed. For the purpose of ensuring accuracy, the tests were carried out three times. The IC50 value of each extract was determined by fitting the data to a calibration curve.

$$\text{Radical scavenging activity \%} = \left(1 - \left(\frac{\text{Abs}_{517}\ \text{control}}{\text{Abs}_{517}\ \text{sample or standared control}}\right)\right) \times 100.$$

Nitric Oxide

It is possible that detecting NO in tissue can be difficult due to the fact that it has a short half-life and there is a possibility that other metabolites will interfere with its detection. This indicates that the technologies used to detect NO must have a high degree of sensitivity. For additional information, it is recommended that a minimum of two methods be utilised in order to accurately measure NO, as each method has its own set of advantages and disadvantages. The Griess reaction, amperometric methods with NO-specific electrodes, fluorescent probes, electrophoresis, chemiluminescence, the oxyhaemoglobin (Hb-O2) test, laser photoacoustics, membrane inlet-mass spectrometry, and the Griess reaction are some of the most prevalent methods that are used to detect NO in plant and animal systems. Using fluorescent probes is yet another way that can be utilised. Both of these methods are capable of measuring the amounts of free nitrogen oxides and nitrogen oxide compounds, such as nitrogen dioxide [8].

$$\text{NO scavenging \%} = \left(\frac{[\text{Abs}_{546}\ \text{control} - \text{Abs}_{546}\ \text{sample}]}{\text{Abs}_{546}\ \text{control}}\right) \times 100.$$

Alpha-amylase assay

In result, a solution that contained enzymes from pig pancreas was combined with 15 ul of plant extract that was diluted in phosphate buffer at a concentration ranging from 50 g/ml to 200 g/ml, and then it was mixed with 5 um of the same. At this point, the next step was to stir the mixture. Following an incubation period of ten minutes at 37 degrees Celsius, twenty litres of starch solution was added to the combination. The reaction was started by allowing the mixture to remain undisturbed for a further thirty minutes at the same temperature. This was accomplished by adding 10 ul of 1M hydrochloric acid and 75 ul of iodine reagent to each well. This brought an end to the process. Therefore, the total volume of all of the wells was equal to one hundred ul. Additionally, in order to facilitate a comparison with the extract, a phosphate buffer with a pH of 6.9 and acarbose at a concentration of 64 g/ml were simultaneously created. The analysis of each and every sample was carried out without the utilisation of either a starch control or an enzyme control. In order to ascertain the percentage of inhibitory impact, we initially measured the absorbance at a wavelength of 580 nm and then utilised the calculation stated below.

$$\text{\% Inhibition} = \left(1 - \frac{\text{Absorbance of the untreated (Control)}}{\text{Absorbance of the test well}}\right) \times 100$$

Paracetamol-Induced Hepatotoxicity In Rats[10]

Group I: Rats of any sex that are albino in condition Weight ranges from 150 to 200 grammes.

Group II: All of the rats in were given paracetamol orally at a dosage of 750 milligrammes per kilogramme of body weight for a period of seven days.

Group III: received test extract (250 mg/kg body weight, orally) and paracetamol (750 mg/kg body weight, orally) for a period of seven days. It was administered orally.

Group IV: Administration of test extract (250 mg/kg body weight, orally) and paracetamol (750 mg/kg body weight, orally) for a period of seven days.

Group V: received the usual medicine silymarin (100 mg/kg body weight, orally) and paracetamol (750 mg/kg body weight, orally) via oral administration for a period of seven days.

Procedure:

Blood was taken through a retro-orbital puncture on the eighth day of the experiment, and it was then allowed to coagulate at room temperature when the experiment was finished. For fifteen minutes, the serum was separated by centrifugation at a speed of three thousand revolutions per minute at a temperature of twenty degrees Celsius. The biochemical parameters, including ALT, ALP, AST,

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and SOD, were determined with the use of a clinical chemistry analyzer (Lab life chem. Master) using commercial kits that were purchased from Autospan Diagnostics Pvt. Ltd. in India.

Estimation of ALP
20 ul of serum or plasma is the procedure. ALP reagent that is working, 1000 ulPerform a thorough mixing, and then promptly aspirate for the purpose of measurement. The analyzer should be programmed according to the assay parameters, and then it should be blanked with filtered water. At a wavelength of 405 nm, the absorbance should be measured after thirty seconds, and the reading should be repeated after every thirty seconds for a total of one hundred and twenty seconds. It is necessary to ascertain the average absorbance change per minute (A/min).

ALP activity = A/min. 27

Estimation of ALT
100 ul of serum or plasma is the procedure. 1000 ul of the working ALT reagent used Perform a thorough mixing, and then promptly aspirate for the purpose of measurement. Analyzer programme according to the parameters of the test Filter the analyzer with water that has been filtered. At 340 nm, the absorbance should be read after sixty seconds, and the reading should be repeated every thirty seconds for a total of one hundred and twenty seconds. The mean absorbance change per minute (A/min) should be determined at this point.

ALT activity = A/min. 1768Estimation of AST
100 ul of serum or plasma is the procedure. The working AST reagent can be 1000 ul. Perform a thorough mixing, and then promptly aspirate for the purpose of measurement. Analyzer programme according to the parameters of the test Filter the analyzer with water that has been filtered.

At 340 nm, the absorbance should be read after sixty seconds, and the reading should be repeated every thirty seconds for a total of one hundred and twenty seconds. It is necessary to ascertain the average absorbance change per minute (A/min).

AST activity = A/min. 1768

Doxorubicin Induced Myocardial Toxicity In Rats: [11]
Rats of any sex that are albino in condition Weight ranges from 150 to 200 grammes.

Group I Animals were given normal saline at a rate of 5 millilitres per kilogramme of body weight intraperitoneally.
The second group of animals received doxorubicin intraperitoneally (i.p.) at a dose of 2.5 mg/kg body weight. They received six equal injections of the drug alternately for a period of two weeks, resulting in a cumulative dose of 15 mg/kg body weight. The animals in Group III were given extract (200 mg/kg body weight, orally) for a period of two weeks, and then they were given vehicle for the subsequent two weeks in an alternating fashion.

As a pretreatment, the animals in group IV were given extract at a dose of 400 mg/kg body weight orally for a period of two weeks. This was followed by the administration of doxorubicin, just as in group 2.

For the purpose of determining cardiac biomarkers such as CPK and LDH, as well as total cholesterol, triglycerides, and LDL, blood samples were collected from the retro orbital plexus after 36 hours had passed since the last treatment. These samples were acquired under light ether anaesthesia and utilising heparinized micro capillaries.

U/L = 9683 x DA 340nm/min; Where DA = Change in absorbance.

Histopathological studies
The liver was kept for twenty-four hours in a neutral buffered formalin solution. After that, it was rinsed with seventy percent ethanol. After that, the tissues were placed in small metal caskets, swirled with a magnetic stirrer, dehydrated with an alcohol series ranging from 70% to 100% alcohol, and then embedded in paraffin with the help of an embedding machine. A rotary ultra-microtome was used to segment the paraffin blocks, and the sections were then spread onto glass slides before being allowed to dry overnight. After the slides had been mounted and stained with hematoxylin and eosin (H&E) dyes, they were examined using a light microscope. The histological examination was carried out by two pathologists.

Statically Analysis:
The statistical analysis was carried out with GraphPad Prism version 5.0.3 installed on the computer. For the purpose of ensuring accuracy, each test was carried out three times. The data are presented in the form of means supplemented by standard errors of the mean, where n is the total

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number of runs. In order to prove that there was a statistically significant difference between the two groups, a p value of 0.05 was regarded to be acceptable. In order to establish that the results were statistically significant, we utilised paired t-tests and analysis of variance, both of which included Bonferroni post hoc testing.

3. RESULT & DISCUSSION

CCL4 HEPATOTOXICITY

Following treatment with carbon tetra chloride (CCl4), rats exhibited liver damage, which was observed as higher blood levels of hepato specific enzymes such as ALT, AST, ALP, and SOD. This was in comparison to the normal control group whose serum levels were not affected. Pretreatment with ethanolic extract at a dose of 200 milligrammes per kilogramme had a greater protective effect on treated rats in comparison to the toxic control group. When it came to protecting the liver from the toxicity that was caused by CCl4, silymarin (100 mg/kg) and extract (200 mg/kg and 400 mg/kg) shown superior protection. When compared to the toxic control animals, the results of Dunnet's test demonstrated a significant decrease in the elevated serum enzyme levels of the animals who were treated with extract.

Table.1 Effect of ethanolic extract of Quisqualis indica on ALP, ALT, AST and SOD in Serum of Control and Experimental rats.

S.no	TREATMENT	ALP	ALT	AST	SOD
1	Normal	92.98±2.19	35.82±2.55	41.08±1.55	6.08±0.57
2	C Cl4 induce (1ml/kg)	193.98±2.59***	177.99±7.60***	140.54±0.69***	4.06±0.08**
3	Silymarin (100mg/kg)	89.49±1.16^{ns}	58.65±1.82**	40.48±1.11^{ns}	6.70±0.21^{ns}
4	Low Dose (200 mg/kg)	114.16±2.42***	80.81±1.25***	56.35±1.38***	4.93±0.41^{ns}
5	High Dose (400 mg/Kg)	100.54±2.65^{ns}	69.86±1.66***	47.84±0.68**	5.50±0.31^{ns}

Values are in mean±SE; Number of animals in each group = 4, ***p< 0.05 Group l Vs Group ll; *** ** *p<0/05 Vs Group ll. As compared with normal group (one way ANOVA followed by dunnet test)

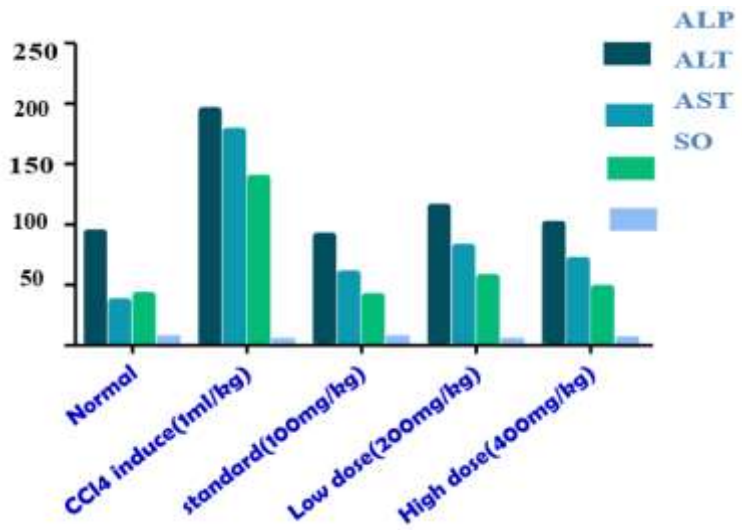

Fig.2 Showing different Enzyme level between Normal, Induced and Treated.

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Histo Pathological Observations

The liver sections from Group I normal control animals had normal liver architecture, with a conspicuous nucleus and nucleolus, intact cytoplasm, and a brought-out central vein (Fig. 5). The hepatic cells exhibiting serum toxicity in the liver sections of the CCl4-treated animals (Group II toxic control) were characterised by focal necrosis, inflammatory cell collection, distributed inflammation throughout the liver parenchyma, and swelling up of vascular endothelial cells (Fig no:6).Silymarin (Group-V) demonstrated defence against hepatic alterations brought on by carbon tetrachloride (Fig. no.5). The hepatic cells with preserved cytoplasm demonstrated that the pretreatment with an ethanolic extract of Quisqualis indica at doses of 200 mg and 400 mg/kg (group III and IV) appeared to significantly prevent the CCl4 toxicity. Additionally, pretreatment significantly reduced inflammatory

Histopathological Studies Ofliver Tissue By CCL4 Hepatotoxicity

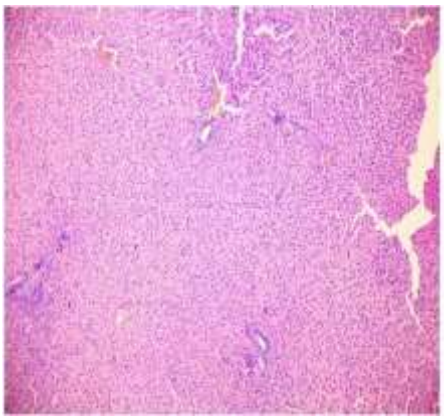
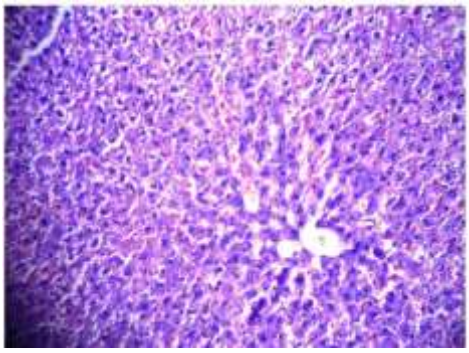


Fig.3 Liver section of group1 (Normal control)



ig.no.4 Liver section of group2 (toxic control)

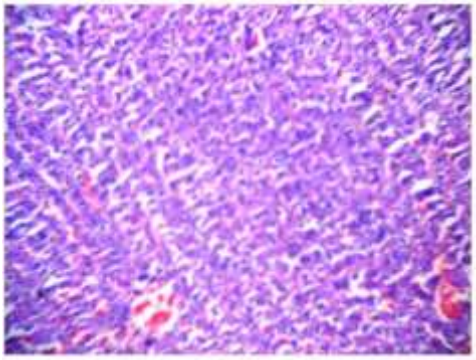


Fig.no.5 Liver section of Group3 (standard control)

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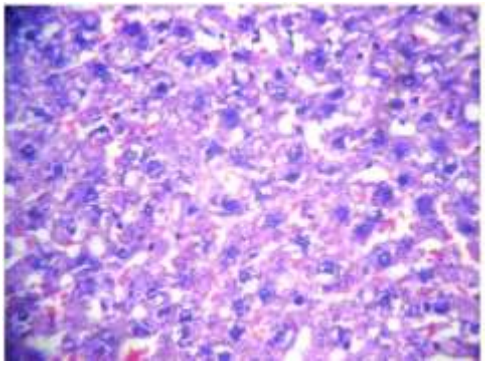

Fig .no. 6 Liver section of Group 4 Extract 200 mg/kg/rat)

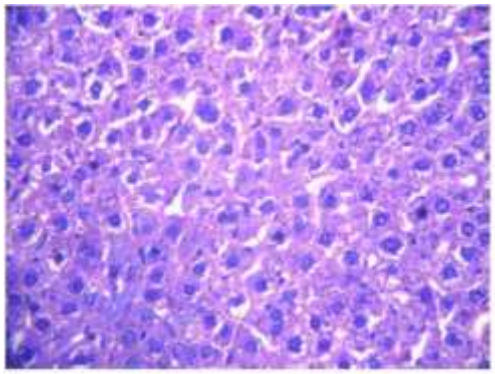

Fig.no. 7 Liver section of group 5 (Extract 400 mg/kg

Carbon tetrachloride (CCl3•) and its metabolites, such as the trichloromethyl peroxyl radical (CCl3O2•), have been shown to play a significant role in the pathophysiology of liver and kidney damage because of the abundant data that supports this hypothesis. It is well recognised that carbon tetrachloride causes damage to the liver that is diffuse. The majority of medications are known to have a negative impact on the kidneys and liver, which is a fact that is widely believed.

Cellular leakage and loss of functional integrity of the hepatocyte are major signs of hepatic cell injury, and an increase in blood enzyme biomarkers such as AST, ALT, and ALP suggests that this cellular leakage and loss of integrity have occurred. Those cells that have been injured will release this damage into the bloodstream, and the measurement of this damage will allow for the discovery of liver injury.The disruption of the plasma membrane of liver cells results in the release of a number of enzymes into the bloodstream. These enzymes include aspartate aminotransferase, alanine aminotransferase, alkaline phosphatase, total bilirubin, and gammaglutamyl transpeptidase. The measurement of their serum is essential because it serves as a quantitative indicator of the degree and kind of damage to the hepatocellular tissue.

After seeing that the levels of blood biomarkers enzymes were normalised in rats that were administered the extract, we were able to confirm that Quisqualis indica possesses hepatoprotective properties. the potential to speed up the process of liver cell regeneration, which would result in a reduction in the amount of enzymes that are released into the bloodstream. SOD, which stands for superoxide dismutase, is an essential intracellular antioxidant enzyme that is present in every aerobic cell. Its primary function is to act as an antitoxic agent against superoxide anion. Despite the fact that it is an extremely sensitive organ in living systems, the liver is also a vital biological organ for metabolic processes. According to the findings of the current experiment, animals who were given paracetamol had very high levels of blood markers, which indicated that they had suffered serious liver damage. A significant reduction in the elevated levels of serum markers was achieved after pretreatment with the extract. Considering that the extract was able to restore serum biomarkers to their normal levels, it is reasonable to assume that it has

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the potential to condition hepatocytes in such a way as to prevent the marker enzymes that are created by paracetamol from going into the circulation. The administration of paracetamol was responsible for the release of marker enzymes into the bloodstream.12–13.

With an increase in biliary pressure comes an increase in the generation of ALP, which in turn leads to an increase in serum levels. It is suggested that the secretory system of the liver cell should be improved at an early stage by the effective regulation of alkaline phosphatase activity.According to the findings of this investigation, the extract significantly boosted the amount of hepatic SOD activity in rats that had previously been injured by paracetamol. According to the available evidence, quisqualis indica extract has the potential to reduce the levels of reactive free radicals (ROS), which in turn reduces the risk of oxidative damage to tissues and increases the effectiveness of the antioxidant enzyme produced by the liver.There is a possibility that cells will die as a consequence of the damage that is brought about by the production of reactive oxygen species (ROS). In the current investigation, it was discovered that the extract of Quisqualis indica was able to lower the amount of reactive free radicals, such as superoxide, hydroxyl, and hydrogen peroxide, as well as the amount of oxidative cellular damage that was caused to hepatocytes. The purpose of this study is to investigate the ways in which Quisqualis indica shields the heart from the harm caused by doxorubicin. The purpose of this study was to determine whether or not Quisqualis indica protected the hearts of rats from the cardiotoxicity that was caused by doxorubicin. The formation of free radicals in cardiac tissue is the cause of doxorubicin oxidative stress, as indicated by the experimental data that is now available. Reactive oxygen species, which include hydroxyl radicals, superoxide radicals, and hydrogen peroxide, have the potential to cause damage to a variety of components that are found within cells. Because of the negative effects that it has on the contractile activity of cardiac myocytes, which are mediated by alterations in energy metabolism, doxorubicin-induced mitochondrial damage is extremely important to the proper functioning of the heart. Following the administration of doxorubicin, Quisqualis indica was able to mitigate the cardiotoxic effects of the drug in a variety of different ways. In light of the fact that the doxorubicin-induced group had raised levels of plasma triglycerides, total cholesterol, and HDL, it is possible that doxorubicin is influencing the metabolism or synthesis of lipids. The current study found that pretreatment with Quisqualis indica not only decreased the levels of lipid profiles in the blood but also increased the levels of HDL cholesterol. The blood lipid profiles of the individuals who took Quisqualis indica showed an improvement, with high-density lipoprotein (HDL) cholesterol levels increasing and bad cholesterol levels decreasing. All of these factors contribute to the lipid-lowering activity of Quisqualis indica, which includes the inhibition of hepatic cholesterol biosynthesis, the stimulation of receptor-mediated LDL catabolism, and the rise in faecal bile acid secretion. The presence of elevated levels of marker enzymes, such as LDH and CK-MB, provided evidence that doxorubicin caused adverse effects on heart tissue in rats. It has been demonstrated through research conducted on rats that quisqualis indica has the ability to inhibit the release of doxorubicin-induced CPK and LDH in the serum.

4. CONCLUSION

In conclusion, our findings revealed that the administration of ethanolic extract of Quisqualis indica at doses of 200 and 400 mg/kg was efficient in protecting against oxidative stress. Additionally, the extract possessed hepatoprotective antioxidant and cardioprotective properties. The presence of these active substances has the potential to restore the illnesses that are associated with hepatic damage and cardiotoxic condition. According to the findings of our study, the extracts of Quisqualis indica result in a considerable decrease in ALT, AST, and ALP levels, as well as an increase in the level of superoxide dismutase (SOD), which demonstrates more remarkable hepatoprotective and antioxidant activity. In a similar manner, it also inhibits the raised markers enzyme (CPK, LDH), and as a result, it also acts as a cardioprotective medicine. Furthermore, we came to the conclusion that Quisqualis indica had fewer adverse effects than silymarin.

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