ISSN 2581-6217

World Journal of Pharmaceutical Science & Technology

Journal homepage: www.wjpst.com

Original Research Article

EVALUATION OF HEPATOPROTECTIVE ACTIVITY OF FRUITS EXTRACT OF *JASMINUM OFFICINALE*

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Received: 15-02-2021, Revised: 25-02-2021, Accepted: 28-02-2021

ABSTRACT

The present study was aimed to evaluate the hepatoprotective effect of *Jasminum officinale* Fruits extract in acute experimental liver injury induced by alcohol in rats. To induce the liver toxicity 24 hour after the last treatment was administered where as for alcohol model alcohol was given for 15 days. Rats were received different treatments such as silymarin (100 mg/kg), low and high doses of *Jasminum officinale* Fruits extract(100 and 500 mg/kg,) orally. The protective effect of prophylactic treatment was analysed by estimation of serum biomarkers like serum glutamate oxaloacetate transaminase (SGOT), serum glutamate pyruvate transaminase (SGPT), alkaline phosphatase (ALP) and bilirubin (total and direct) and by histopathological observation. The activities of serum biomarkers were significantly decreased in all treated groups compared with toxic control. It was concluded that high and the low dose of *Jasminum officinale* Fruits extract (JSFE) demonstrated reduced serum biomarkers activity significantly which was supported by histopathological study.

KEYWORDS: *Jasminum officinale* Fruits extract, SGPT, SGOT, ALP, Bilirubin (Total and Direct)

1. INTRODUCTION

1.1 The liver

The liver is the largest solid organ, the largest gland and one of the most vital organs that functions as a centre for metabolism of nutrients and excretion of waste. Its primary function is to control the flow and safety of substances absorbed from the digestive system before distribution of these substances to the systemic

circulatory system. A total loss of liver function could leads to death within minutes, demonstrating the liver's great importance, in view of this, this study was undertaken to review the physiology of the liver with a view to keep it functioning at its optimum and maintaining good health so as to avoid liver damages such as fatty liver, liver fibrosis and cirrhosis.

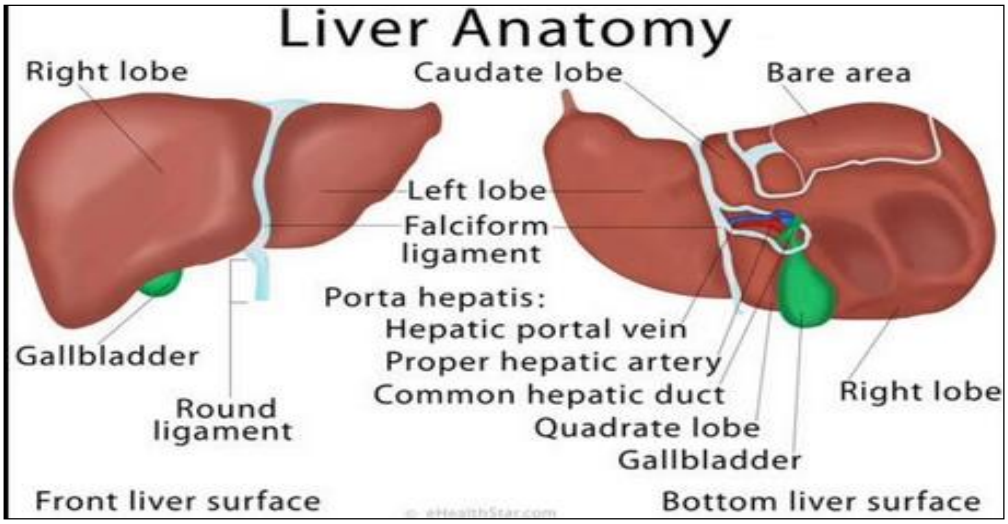

Figure 1: Anatomy of the liver

1.2 General Description of the Liver

The liver weighs approximately 1500g and accounts for approximately 2.5% of adult body weight (Moore and Dalley, 2006). The surface of the liver is smooth and dome shaped, where it is related to the concavity of the inferior surface of the diaphragm. The liver lies mainly in the right upper quadrant of the abdomen where it is hidden and protected by the thoracic cage and diaphragm. The normal liver lies deep to the ribs 7 – 11 on the right side and crosses the midline towards the left nipple (Moore and Dalley, 2006). Allen (2002) explained that the liver is divided into 4 lobes: right, left, caudate, and quadrate. The right and left lobes are the largest, while the caudate and quadrate are smaller and located posteriorly. Two ligaments are visible anteriorly. Superiorly, the falciform ligament separates the right and left lobes. Inferior to the falciform ligament is the round ligament, which protrudes from the liver slightly. Also visible anteriorly on the most inferior portion of the right lobe is the gallbladder. Posteriorly, many more interesting structures are visible. Allen (2002) reported that the caudate lobe is located superiorly, approximately between the right and left lobes. Adjacent to the caudate lobe is the sulcus for the inferior vena cava. Just inferior to the caudate lobe is the porta hepatis, where the hepatic artery and hepatic portal vein enter the liver. The portal vein carries nutrient laden blood from the digestive system. Inferior to the porta hepatis is the bile duct which leads back to the gallbladder. Allen (2002) also explained that the hepatic vein, where post-processed blood leaves the liver, is found inferior and adjacent to the sulcus for the inferior vena cava. The liver is held on place by a system of mesenteries posteriorly, and is also attached to the diaphragm via the falciform ligament. Additionally, most of the liver is covered by visceral peritoneum.

1.3 Functions of the liver

The liver has numerous functions best grouped into secretion of bile, metabolism of bilirubin, vascular and hematologic functions, metabolism of nutrients, metabolic detoxification and storage of minerals and vitamins.

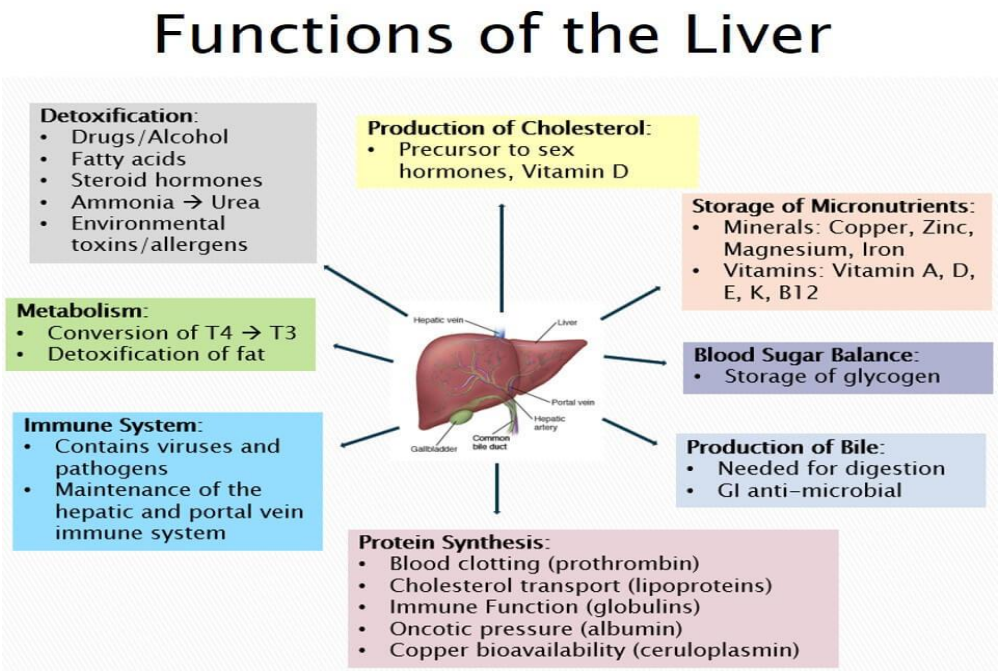

Figure 2: Functions of the liver

1.3.1 Blood Purification – as the journey of liver start throughout the body, the blood from stomach and intestine is the liver and it prevent the contaminants and also removes the waste product from the body such as:

- Drugs
- Bacteria
- Fungi
- Viruses
- Parasites
- Food Additives
- Pesticides and herbicides
- Chemicals
- Fats
- Alcohol
- Dead cells

1.3.2 Detoxification – Liver also perform the function of detoxification as it detoxifies alcohol, heavy metal, drugs, chemicals, toxic by product from the blood. Housing an ingenuous cleaning system, the liver detoxifies infectious organisms, alcohol, heavy metals, drugs, chemicals, toxic by products and other poisons from the blood (Akinloye *et al.,* 2011). Digestion – The liver produces bile, a substance needed to digest and absorb fats. Bile used in digestion by helping the body which absorb fat and certain vitamins, including Vitamins A, D, E and K. Manufacturing **1.3.3 Processing –** The liver perform the most of the functions via different organs like skin, mouth, lung, Considered to be the biochemical factory of the body, the liver metabolizes substances in the blood stream (Nayak *et al.,* 2011).

1.3.4 Storage – The cells of the liver also act as a power house of body for many substances, such as iron, vitamins, minerals and glycogen until they are needed. When blood sugar levels drop and the body needs energy quickly, the liver converts the stored glycogen into glucose and releases it into the bloodstream. In this way, the liver supplies us with fast-acting energy.

1.4 Liver diseases

Liver disorders are the most common health hazard found in developing countries due to dietary habits, alcohol ingestion, poor hygiene, unsupervised drug use and smoking etc. Liver diseases can be non-inflammatory, inflammatory and degenerative. High levels of plasma total cholesterol (LDL-C) and triacylglycerols (TGs) are associated with high risk of atherosclerosis and cardiovascular disease owing to the hepatic insufficiency (Dominiczak, 2005; Ekaidem *et al.,* 2007). Any clinical defects or conditions which rise to impairment of liver are known as liver diseases. Liver diseases are mainly classified into two types: acute and chronic liver diseases. The acute liver disease occurs rapidly and usually exists for a very short duration. Chronic liver diseases are typically long term, generally over 6 months. In the clinical circumstances, the chronic disease causes periodical destruction and regeneration of liver parenchyma generates fibrosis and cirrhosis of the liver (Crawford, 2007). Eventually, it causes an extensive degree of inflammation in the liver producing chronic hepatitis, cirrhosis, and liver carcinoma.

1.5 Hepatotoxicity

Hepatotoxicity implies chemical-driven liver damage. Certain medicinal agents, when taken in overdoses and sometimes even when introduced within therapeutic ranges, may injure the organ. Other chemical agents, such as those used in laboratories and industries, natural chemicals (e.g., microcystins) and herbal remedies can also induce hepatotoxicity. Chemicals that cause liver injury are called hepatotoxins. More than 900 drugs have been implicated in causing liver injury and it is the most common reason for a drug to be withdrawn from the market. Chemicals often cause subclinical injury to liver which manifests only as abnormal liver enzyme tests. Drug induced liver injury is responsible for 5% of all hospital admissions and 50% of all acute liver failures. More than 75% of cases of idiosyncratic drug reactions result in liver transplantation or death (Ostapowicz *et al.,* 2002).

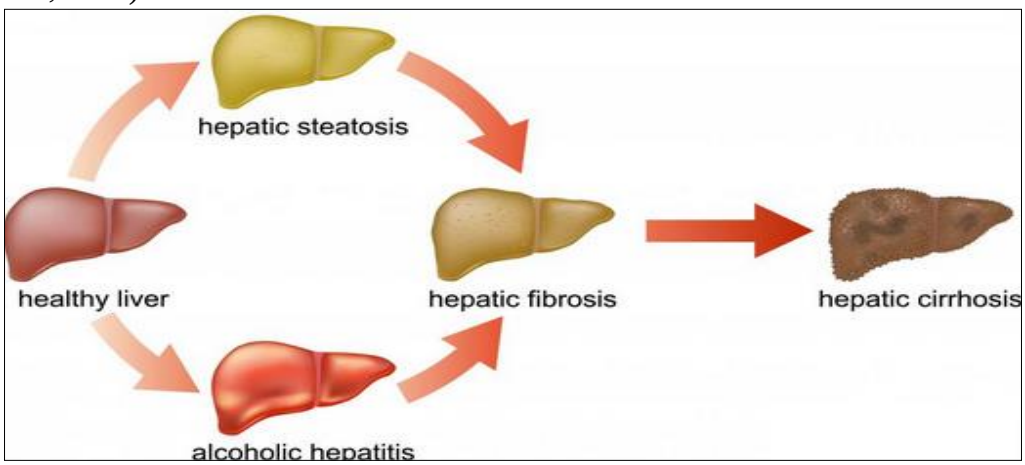

Figure 3: chemical-driven liver damage

On the other hand, the majority of the hepatotoxicity agents damage hepatocytes and subsequently impair the kidney function mostly through lipid peroxidation or other oxidative forms. In cases of liver damage, the capacity of the natural antioxidant system is inadequate. ROS are generated by environmental causes such as Xrays, pollutants, ultraviolet radiation, or metabolic process in the mitochondria (Haque *et al.,* 2014).

1.5.1 Hepatotoxicity inducing agents

Many xenobiotics like chemicals, drugs, house hold things, herbs and environmental factors are well-known to induce hepatotoxicity. Most significant for xenobiotic-induced liver injury, the centrilobular (zone-3) hepatocytes are the 1st sites of haemoprotein P450 accelerator activity, which regularly makes them at maximum risk of xenobiotic-induced liver injury. CCl4, N-nitrosodiethylamine,Acetylaminofluorene,Galactosamine, d-Galactosamine/ Lipopolysaccharide, TAA, Antitubercular drugs, PCM, Arsenic etc (Hernandez-Aquino *et al.,* 2017).

2. MATERIAL AND METHOD

2.1 Plant material collection

Fruits of *Jasminum officinale* were collected from local area of Bhopal in the month of September, 2020.

2.2 Extraction by maceration process

100 gm of dried powdered fruits of *Jasminum officinale* fruits has been extracted with hydroalcoholic solvents (Ethanol 70%) using maceration process for 48 hrs, filtered and dried using vacuum evaporator at 40^0C.

2.3 Determination of percentage yield

The percentage yield of each extract was calculated by using following formula:

$$\text{Percentage yield} = \frac{\text{Weight of Extract}}{\text{Weight of powder drug Taken}} \times 100$$

2.4 Phytochemical analysis of plant extract

The *Jasminum officinale* extract acquire was subjected to the precursory phytochemical analysis following standard methods by Khandelwal and Kokate. The extract was screened to identify the presence of various active principles of alkaloids, glycosides, phenols, flavonoids, Amino acid, Cabohydrates, Terpenoids, Saponins, Steroids.

2.5 Total Phenolic content estimation

The total phenolic content of the extract was determined by the modified Folin-Ciocalteu method.

Procedure: 50 mg Gallic acid was dissolved in 50 ml methanol, various aliquots of 5- 25µg/ml was prepared in methanol**.** 10mg of dried extracts of were dissolved in 10 ml methanol and filter. Two ml (1mg/ml) of this solution was used for the estimation of phenol. 2 ml of each extract or standard was mixed with 1 ml of Folin-Ciocalteu reagent (previously diluted with distilled water 1:10 v/v) and 1 ml (7.5g/l) of sodium carbonate. The mixture was vortexed for 15s and allowed to stand for 15 min for colour development. The absorbance was measured at 765 nm using a spectrophotometer.

2.6 Total flavonoids content estimation

Determination of total flavonoids content was based on aluminium chloride method.

Procedure: 50 mg quercetin was dissolved in 50 ml methanol, and various aliquots of 5- 25µg/ml were prepared in methanol.10mg of dried extracts of were dissolved in 10 ml methanol and filter. Three ml (1mg/ml) of this solution was used for the estimation of flavonoid. 1 ml of 2% $AlCl_3$ methanolic solution was added to 3 ml of extract or standard and allowed to stand for 15 min at room temperature; absorbance was measured at 420 nm.

2.7 Alcohol induced hepatoprotective activity of fruits of *Jasminum officinale*

Animals:-

Wistar rats (180–250 g) were group housed (n= 6) under a standard 12 h light/dark cycle and controlled conditions of temperature and humidity (25±2 °C, 55–65%). Rats received standard rodent chow and water *ad libitum*. Rats were acclimatized to laboratory conditions for 7 days before carrying out the experiments. All the experiments were carried in a noise-free room between 08.00 to 15.00 h. Separate group (n=6) of rats was used for each set of experiments. The animal studies were approved by the Institutional Animal Ethics Committee (IAEC), constituted for the purpose of control and supervision of experimental animals by Ministry of Environment and Forests, Government of India, New Delhi, India.

Acute toxicity studies

Acute oral toxicity was conducted according to the method of Organisation for Economic Co-operation and Development (OECD) (OECD, 2001). Animals were kept fasting providing only water, fruits of *Jasminum officinale* (50,100,300,500,1000,2000 mg/kg/day) was administered orally for 4 days of six groups of rats

(n=6) and the animals were kept under observation for mortality as well as any behavioral changes for evaluation of a possible hepatoprotective effect.

Experimental designs

Group –I: Normal control (Sterile distilled water ml/kg, p.o.)
Group –II: 30% Alcoholic solutions were prepared in sterile distilled water (100 ml/kg, p.o.)
Group –III: Silymarin (100 mg/kg, p.o.) + 30% Alcoholic (100 mg/kg, p.o.)
Group -IV: *Jasminum officinale* Extract (100mg/kg, p.o.) 30% Alcoholic (100 mg/kg, p.o.)
Group –V: *Jasminum officinale* Extract (500mg/kg, p.o.) + 30% Alcoholic (500 mg/kg, p.o.)

Animals were divided into five groups of 6 animals each. The first group received Sterile distilled water 1 ml/kg p.o. The group II received 30% Alcoholic solutions (100 ml/kg, p.o.). The groups III, IV and V received silymarin, 100 mg/kg and 500 mg/kg of Hydroalcoholic extract of *Jasminum officinale* fruits and respectively once a day for 21 days. After 21st days animals was anaesthetized with ether for collection of blood from retro orbital plexus, and then sacrificed under ether anesthesia for the removal of liver. Various biochemical analysis were carried out (Jiang *et al.,* 2004; Saleem *et al.,* 2008).

Biochemical Evaluation in Serum

Serum glutamic pyruvate transaminase (SGPT), Serum glutamic oxaloacetic transaminase (SGOT), Alkaline phosphatase (ALP) and total bilirubin was estimated by using commercial kits as per the manufacturer instructions.

3. RESULTS

3.1 Result of Percentage Yield The yield of extracts obtained from samples using hydroalcoholic solvents are depicted in the table 1.

Table 1: % Yield of fruit extracts of *Jasminum officinale*

S. No.	Solvents	% Yield
1.	Hydroalcoholic	23 %

3.2 Phytochemical screening of extracts

Table 2: Phytochemical screening of extracts *of Jasminum officinale* fruits

S. No.	Constituents	Hydroalcoholic extract
1.	**Alkaloids**	
	Mayer's Test	+ve
	Wagner's Test	+ve
2.	**Glycosides**	
	Legal's test	+ve
	Molish's Tes	+ve
	Salkowski's Test	+ve
3.	**Flavonoids**	
	Lead acetate	+ve

	Alkaline test	+ve
4.	**Phenolics** Ferric Chloride Test	 +ve
5.	**Proteins and Amino acids** Xanthoproteic test Ninhydrin Test	 -ve -ve
6.	**Carbohydrates** Molisch's Test Fehling's test	 +-ve -ve
7.	**Saponins** Froth Test Foam test	 +ve +ve
8.	**Diterpins** Copper acetate test	 -ve

3.3 Results of estimation of total phenolic contents

Table 3: Total phenolic and total flavonoid content of *Jasminum officinale* fruits extract

S. No.	Extract	Total Phenol (mg/100mg)	Total flavonoid (mg/100mg)
1.	Hydroalcoholic *extract*	0.316	0.135

3.4 Results of *In –Vivo* hepatoprotective activity of *Jasminum officinale* fruits extract

Table 4: Effect of Hydroalcoholic extract of *Jasminum officinale* fruits and Silymarin on % SGOT levels in Alcohol induced induced hepatotoxicity in rats.

Treatment	Dose	SGOT (%)
Normal	1 ml/kg, p.o.	91.46 ± 2.99
Alcohol induced Hepatotoxicity	100 ml/kg, p.o.	224.74 ± 7.84
Jasminum officinale Extract	100 mg/kg p.o.	177.2 ± 4.35
Jasminum officinale Extract	500 mg/kg p.o.	153.63 ± 5.47
Silymarin	100 mg/kg p.o.	107.78 ± 3.40

Values are expressed as the mean ± SEM of six observations. *** $P<0.001$ vs. control treatment (One-way ANOVA followed by Dunnett's test)

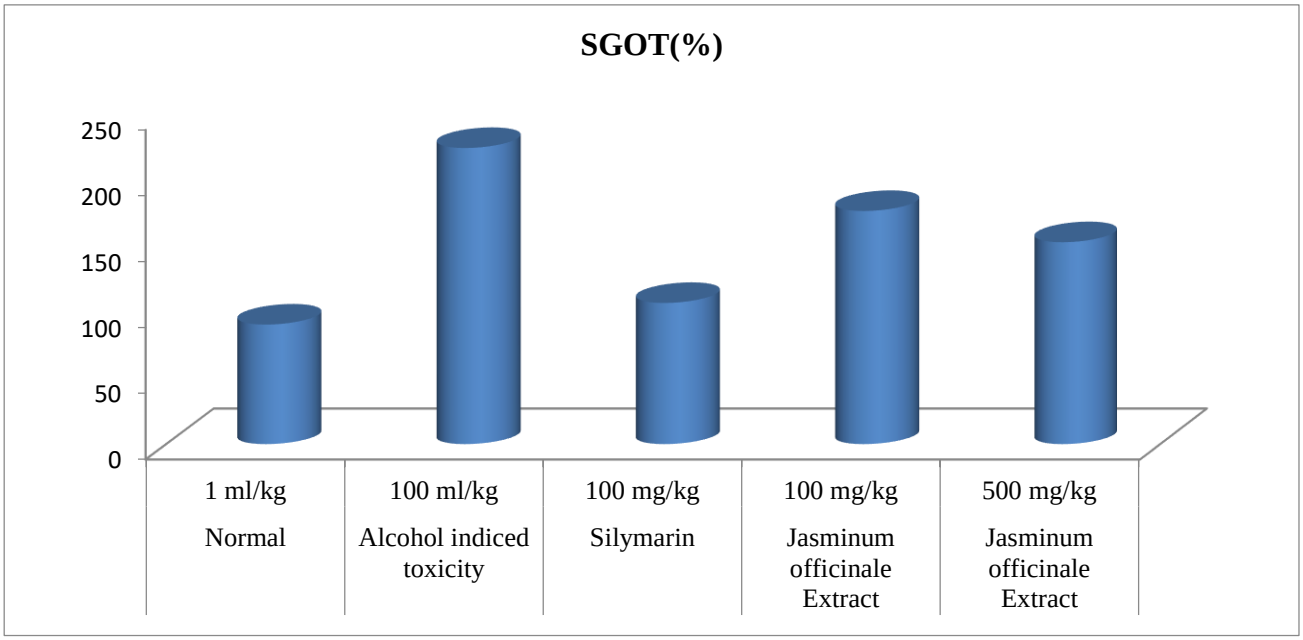

Figure 4: Effect of *Jasminum officinale* Fruits and Silymarin on %SGOT levels in Alcohol induced hepatotoxicity in rats

Table 5: Effect of Hydroalcoholic extract of *Jasminum officinale* Fruits and Silymarin on %SGPT levels in Alcohol induced hepatotoxicity in rats.

Treatment	Dose	SGPT (%)
Normal	1 ml/kg, p.o.	78.73 ± 8.64
Alcohol induced hepatotoxicity	100 ml/kg, p.o.	331.72 ± 5.37
Jasminum officinale Extract	100 mg/kg p.o.	223.12± 7.15**
Jasminum officinale Extract	500 mg/kg p.o.	173.85 ± 4.11*
Silymarin	100 mg/kg p.o.	127.91 ± 5.97***

Values are expressed as the mean ± SEM of six observations. *** $P<0.001$ vs. control treatment (One-way ANOVA followed by Dunnett's test)

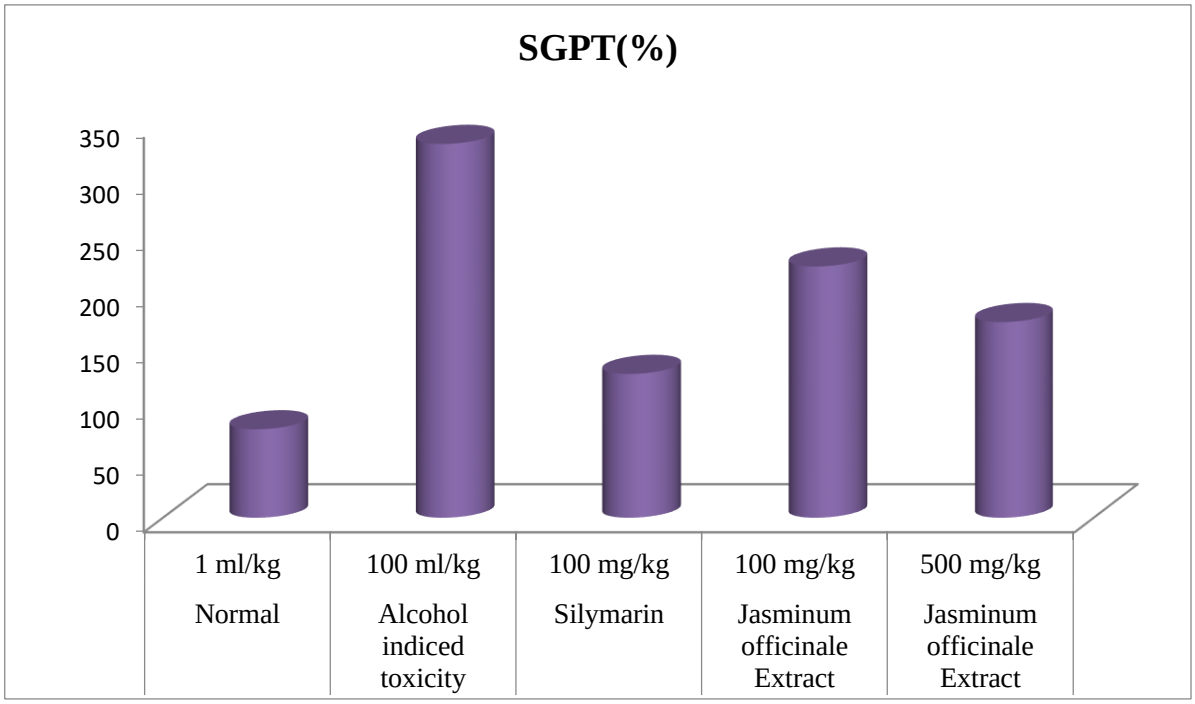

Figure 5: Effect of *Jasminum officinale* Fruits and Silymarin on %SGPT levels in Alcohol induced hepatotoxicity y in rats

Table 6: Effect of *Jasminum officinale* Fruits and Silymarin on % serum bilirubin levels in Alcohol induced hepatotoxicity in rats.

Treatment	Dose	Serum Bilirubin (%)
Normal	1ml/kg, p.o.	0.31± 0.09
Alcohol induced hepatotoxicity	100 ml/kg, p.o.	0.98 ± 0.02
Jasminum officinale Extract	100 mg/kg p.o.	0.74 ± 0.01 ***
Jasminum officinale Extract	500 mg/kg p.o.	0.47 ± 0.01 ***
Silymarin	100 mg/kg p.o.	0.38 ± 0.01

Values are expressed as the mean ± SEM of six observations. *** $P<0.001$ vs. control treatment (One-way ANOVA followed by Dunnett's test)

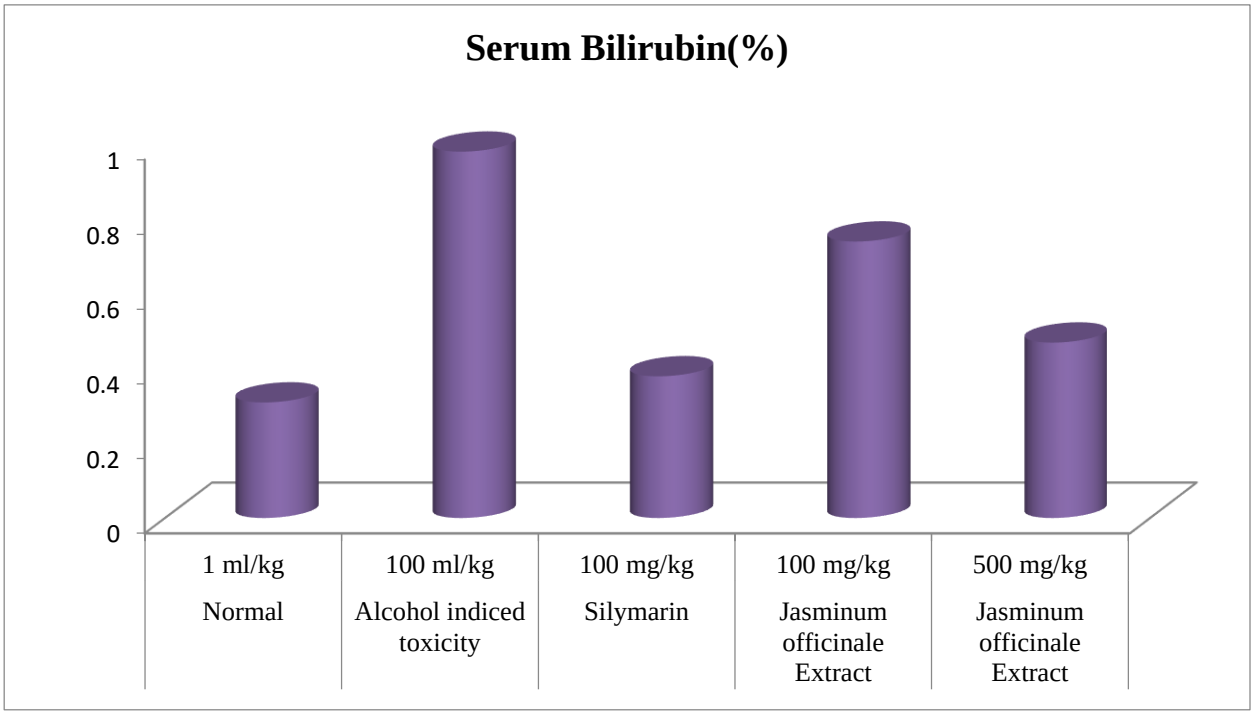

Figure 6: Effect of *Jasminum officinale* Fruits and Silymarin on % serum bilirubin levels in Alcohol induced hepatotoxicity in rats

Table 7: Effect of *Jasminum officinale* Fruits and Silymarin on % ALP levels in Alcohol induced hepatotoxicity in rats.

Treatment	Dose	ALP (%)
Normal	1 ml/kg, p.o.	32.32 ± 3.18
Alcohol induced hepatotoxicity	100 mg/kg, p.o.	498.10 ± 6.62
Jasminum officinale Extract	100 mg/kg p.o.	324.86 ± 21.1
Jasminum officinale Extract	500 mg/kg p.o.	232.86 ± 8.26
Silymarin	100 mg/kg p.o.	161.11 ± 6.28

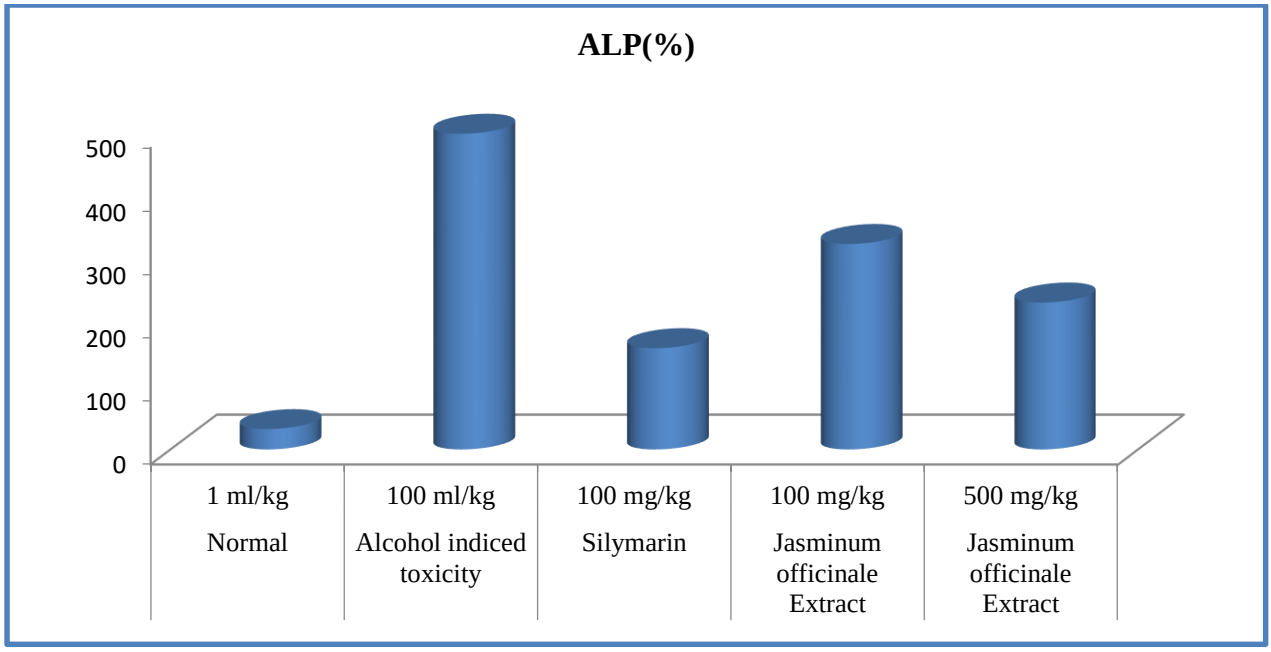

Figure 7: Effect of *Jasminum officinale* Fruits and Silymarin on % ALP levels in Alcohol induced hepatotoxicity in rats

DISCUSSION

Jasminum officinale fruits are an important medicinal plant which is used in traditional medicine to treat many diseases. Increased in the level of activities of SGPT, SGOT and ALP in the blood reflect the damage of liver hepatocytes and indirectly impairment of liver functions following Alcohol-induced hepatotoxicity. In Table 4,5,6,7 SGPT, SGOT and ALP activities were significantly elevated ($p<0.05$) after administration of Alcohol-induced hepatotoxicity. Treatments with 100 and 500 mg/ kg of *Jasminum officinale* Fruits extract significantly reduced the elevation of these enzymes ($p<0.05$). The reduction of liver enzymes was seen to be to the level of the control group and it was also similar to the level of group pretreated with silymarin. One of the hallmark signs of hepatic injury or damage is apparent leakage of cellular enzymes into plasma. In addition, the extent and type of liver injury or damage can be accessed based on the presence or absence of specific enzymes in the blood stream. In general measurement of alanine aminotransferase, aspartate aminotransferase and alkaline phosphatase are commonly used as marker enzymes in accessing Alcohol induced hepatotoxicity. In this study, hepatoprotective effect of *Jasminum officinale* Fruits is evidenced by the improvement SGPT, SGOT, ALP and serum bilirubin levels. Treatment with *Jasminum officinale* Fruits extract suppresses Alcohol induced SGPT, SGOT, ALP and serum bilirubin elevations. The increase is time dependent with significant elevation noted after 48 h ($p<0.05$) suggesting severe hepatocellular damage caused by leakage of these enzymes into circulation that is normally cytoplasmic in location.

Both the test groups i.e. low dose and high dose treated Groups shown dose dependent hepatoprotective activity. The test groups containing the plant extract alone showed an improvement in the liver activity. It clearly indicates that the plant "*Jasminum officinale* Fruits" has the hepatoprotective activity. This study showed that *Jasminum officinale* Fruits has a significant protective action against the hepatotoxicity induced by the drugs used in the treatment of tuberculosis. The hepatoprotective role of *Jasminum officinale* Fruits might be due to its antioxidant potential mechanism suggesting that the extract of plant may be useful to prevent the oxidative stress induced liver damage.

CONCLUSION

Natural products are playing a vital role in health care for decades. Often different sources of natural products, plants have been a source of chemical substance, which serves as drugs in their own right or key ingredients in formulation containing synthetic drugs. Herbal based therapeutics for liver disorders has been in use in India for a long time and has been popularized world over by leading pharmaceuticals. Despite the significant popularity of several herbal medicines in general, and for liver diseases in particular, they are still unacceptable treatment modalities for liver diseases. The use of natural remedies for the treatment of liver diseases has a long history, starting with the Ayurvedic treatment, and extending to the Chinese, European and other systems of traditional medicines. A large number of plants and formulations have been claimed to have hepatoprotective activity. The present study concluded that the ethanolic extract of *Jasminum officinale* Fruits may be used as an effective hepatoprotective agent.

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