Hepatoprotective Activity of Herbal Plants

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Abstract- *Liver is a vital organ and plays important role in metabolism and excretion of unwanted substances. Liver diseases are major problem and it is worldwide. The main cause of this problem is consumption of chemicals and drugs. Drugs having toxic effects on the liver are called hepatotoxic drugs and on other handdrugs that are protecting the liver against harmful and toxic effects is understood as a hepatoprotective drugs. Hepatoprotective effects are attributed to its antioxidant activity, which restores the activity of superoxide dismutase, catalase, and glutathione peroxidase to normal levels, and increases glutathione content and levels of lipid peroxidation and hydroperoxides in the liver. There are many synthetic drugs which have too many side effects on liver. Thus, it is necessary to identify pharmaceutical alternatives for the treatment of liver diseases, which are alternatives being more effective and less toxic The use of plants and the consumption of different fruits have played basic roles in human health. Clinical analysis has conjointly shown that herbs have real utility in the treatment of diseases. There is a lack of reliable hepatoprotective drugs in modern medicine to prevent and treat drug-induced liver damage. Which can be fulfilled by herbal drugs as we have discussed below.*

Keywords- Hepatoprotective, hydroperoxides, hepatotoxic, paracetamol,

I. INTRODUCTION

The liver is one of the most important organs in the human body. In fact, it is a huge gland that takes part in many processes of the body – the metabolism of various substances, including those coming from outside, in the production of bile, which is involved in the digestive process The main functions of the liver are: Detox, Processing of vitamins and microelements, Digestion. First of all, the liver is designed to split and remove toxins from the body. Toxins can come directly from the environment, where chemicals or medications can be their source, or they can be formed during digestion. Such compounds include phenol, acetone, ketone compounds. The liver receives various vitamins, both fat-soluble and water-soluble (D, E, K, B, PP, A), and also trace elements – copper, iron, folic acid. In the liver, they are metabolized and become available to the body A special fluid is produced in the liver – bile. It enters the gallbladder and then into the duodenum through the bile ducts and participates in the digestive process, splitting complex fats and proteins.

Liver is one of the vital organs and largest gland of the human body occupied in right hypochondriac region. It weighs about 1200 to 1600 gm, roughly 2% in adult and 5% in infant. The liver is the main organ responsible for the biosynthesis, uptake and degradation of proteins and enzymes. It is the second largest organ in the body, and is often considered as the most important one. The liver receives a dual blood supply with about 20% of blood coming from the hepatic artery and 80% from the portal circulation. The most common liver diseases, including viral hepatitis, fatty liver, liver fibrosis, cirrhosis, and liver cancer, are major diseases threatening human health and are the leading cause of deaths worldwide . Although there has been remarkable progress in the treatment of liver diseases over the last several decades, most of the therapies still do not yield satisfactory outcomes in patients . Alcoholic liver disease and nonalcoholic fatty liver disease are two common types of liver disease. According to findings there are more than 1000 drugs are actively consumed which are proven to produce toxicity on the liver and subsequently induce oxidative stress, steatosis and cell death. The main problem with these medications is the usage of high doses, which usually lead to hepatotoxicity in humans and experimental animals. Most of the anti-cancer, anti-analgesic, anti-hypertensive, anti-diabetic and antiinflammatory drugs and antidepressadnts can be hepatotoxic. A phytotherapeutic approach to modern drug development can provide many valuable drugs from traditional medicinal plants. Search for pure phytochemicals as drugs is time consuming and expensive. Various plants and polyherbal formulations are used for the treatment of liver diseases. However, in most of the severe cases, the treatments are not satisfactory. Although experimental evaluations were carried out on a good number of these plants and formulations, the studies were mostly incomplete and insufficient. Natural products provide a repertory for the discovery of new leads drugs that can be used in treating different types of illnesses such as cancer, inflammation and liver diseases. There are a number of drugs or therapies available for the treatment of hepatic disorders, but still there is a need for the novel drug discovery because of various adverse reactions and expensiveness. Hence drugs from herbal origin are becoming popular and acceptable worldwide. For developing satisfactory herbal combinations to

treat severe liver diseases, plants have to be evaluated systematically for properties such as antiviral activity, antihepatotoxicity , stimulation of liver regeneration and choleretic activity. The plants with remarkable activities for each of the above properties have to be identified. Single plant may not have all the desired activities. A combination of different herbal extracts/'fractions is likely to provide desired activities to cure severe liver diseases. Development of such medicines with standards of safety and efficacy can revitalise treatment of liver disorders and hepatoprotective activity. It is estimated that about 7,500 plants are used in local health traditions in, mostly, rural and tribal villages of India. Out of these, the real medicinal value of over 4,000 plants is either little known or hitherto unknown to the mainstream population. The classical systems of medicine such as Ayurveda, Siddha, Unani and Tibetan use about 1,200 plants 2 . A detailed investigation and documentation of plants used in local health traditions and pharmacological evaluation of these plants and their taxonomical relatives can lead to the development of invaluable plant drugs for many dreaded diseases.

In the present work, authors had reviewed the articles of hepatoprotective activity of the medicinal plants (Nigella Sativa ,Mimosa Pudica, Curcuma longa, Grape fruit, Spirulina,& Tulsi dates,ginger,green tea, grapes, berries,Nopel)

Tulsi (Ocimum sanctum)

Commonly known as holy basil or tulsi, is an aromatic perennial plant in the family Lamiaceae. It is native to the Indian subcontinent and cultivated plant throughout the Southeast Asian tropics.It is also planted in the kitchen garden and as an indoor plant since it is kept sacred in Hindu philosophy. Holy basil helps kill bacteria and infections. The primary active compound of holy basil oil is eugenol which helps fight skin-related disorders, it also protects the heart from the harmful effects of free radicals. Eugenol also proves useful in reducing cholesterol levels in the blood. Small amounts of eugenol can prevent toxin-induced damage in the liver, it is effective against diabetes mellitus, hypertension, cancers, bronchitis, and found to have anti-microbial properties. KingshukLahon and Swarnamoni Das performed a study and evaluated by performing an assay of the serum proteins, albumin globulin ratio, alkaline phosphatase, transaminases, and liver histopathology.The Ocimum sanctum showed better hepatoprotection than the Ocimum sanctum and silymarin combination. However, the given doses in the experiment the Ocimum sanctum leaf extract alone and combination with silymarin showed a lesser hepatoprotective effect than silymarin alone.{1}

Grapefruit (Citrus paradisi)

The grapefruit (Citrus paradisi) is a subtropical citrus fruit known for its juicy, fleshy/pulpy, large, sour to semisweet, and little bitter taste from the Family Rutaceae The grapefruit first appeared in the *18th century*, as a result of crossing a pomelo and an orange. It is named "grapefruit" because it grows in clusters, similar to grapes. The interior part of the fruit is pulpy, juicy, and segmented. It varies in color from pale yellow to dark pink. The grapefruit originated on Barbados Island, but it is cultivated in Mexico, Spain, Morocco, Israel, Jordan, South Africa, Brazil, Jamaica, and also on the Asian continent.It contains a range of essential vitamins and minerals. People can consume the fruit whole or as a juice or pulp.It contains significant levels of vitamin C, folic acid, phenolic acid, potassium, calcium, iron, limonoids, terpenes, monoterpenes, and D-glucaric acid. Grapefruit juice is used for *asthma*, *high cholesterol*, *"hardening of the arteries"* (atherosclerosis), cancer, improving levels *of red blood cells*. It is also used to reduce stomach complaints in people with eczema (atopic dermatitis), increasing Immunity power, Help Prevent Insulin Resistance and Diabetes,Improve Heart Health, Reduce the Risk of Kidney Stones.SeoHJ analyzed the role of a naringin supplement in the regulation of lipid and ethanol metabolism in male Sprague-Dawley rats. It was observed that Among the ethanol-treated groups, naringin supplements significantly lowered the plasma ethanol concentration, with simultaneous increases in ADH and/or ALDH activity. However, among the ethanol-treated groups, naringin supplementation resulted in a significant decrease in hepatic triglycerides (TGs) and plasma and hepatic total cholesterol (TC), as compared to the naringin free group naringin would appear to contribute to alleviating the adverse effects of ethanol ingestion by enhancing ethanol and lipid metabolism, as well as promoting the hepatic antioxidant defense system.Naringin supplementation significantly increased high-density lipoprotein-c (HDL cholesterol) and HDL-c/TC ratio while lowering the AI value among the ethanol-treated groups. Hepatic lipid accumulation was also significantly reduced in the naringinsupplemented groups compared with the naringin-free group among ethanol-treated groups.{2}

Blue-green algae spirulina (Spirulina maxima, Spirulina platensis, and Spirulina fusiformis)

Spirulina or Arthrospira is a blue-green alga it got fame after it was successfully used by NASA as a dietary supplement for astronauts for space missions.Spirulina is an organism that grows in both fresh and saltwater.it is a biomass of cyanobacteria (blue-green algae) that can be consumed by

humans and animals. This alga represents an important staple diet in humans and has been used as a source of protein and vitamin supplements in humans without any *significant side effects*. It is a type of cyanobacteria, which is a family of single-celled microbes that are often referred to as blue-green algae. like plants, cyanobacteria can produce energy from sunlight by photosynthesis. There are three species of Blue-green algae spirulina *Arthrospira platensis, A. fusiformis, and A. maxima*, and *Arthrospira* is used as a dietary supplement or whole food. It is also used as a feed supplement in the aquaculture, aquarium, and poultry industries.Phycocyanin is the main active compound in spirulina It can modulate immune functions and exhibits anti-inflammatory properties by inhibiting the release of histamine by mast cells. Studies indicate that spirulina has the capacity of lower triglycerides and "bad" LDL cholesterol and it can also simultaneously raise "good" HDL cholesterol. Spirulina may have anti-cancer properties and appears especially effective against a type of precancerous lesion of the mouth called OSMF. Spirulina may provide multiple exercise benefits, including enhanced endurance and increased muscle strength, in one study made by *Kuriakose {4}*.In which hepatoprotective effect of an ethanolic extract of Spirulina (EESLO) was tested on the damage produced by paracetamol (PCM) in rats. It was seen in results that,the degree of lipid peroxidation (TBARS), antioxidant enzymes (SOD, CAT, GPx, and GST), and the activity of ASAT and ALAT, which got altered by high doses of PCM, got recovered and results showed that EESLO could act as a hepatoprotective agent and that its mechanism of action was related to antioxidant phenomena. Another study was carried out by *Kepekçi* , he believed was that the phenolic compounds constitute the main secondary metabolites,with high pharmaceutical potential, he decided to study the hepatoprotective potential of the biomass of S.platensis, which are enriched with phenolic compounds (SP1) and with large amounts of phenolic compounds (SP2) against acute CCl4-induced hepatotoxicity in rats.The results were seen like this, The increases in ALAT, ASAT, and MDA levels, together with the decreases in antioxidants-superoxide dismutase (SOD), and catalase (CAT) activities, were significantly improved by SP2.lymphocyte infiltration, ballooning degeneration, and hepatocyte injury, as well as irregular lamellar organization, dilation of the endoplasmic reticula, and the presence of great numbers of cytoplasmic vacuolizations, were reversed by SP2.

Grapes (Vitisvinifera L)

It is a climber plant. it grows freely and need support of other trees /object for its proper growth and good quality. it is the raw material for the manufacture of wine and other alcoholic beverages.There are approximately 3000 varieties of grapes in the world, grapes are classified into two large groups: (1) designated for consumption with meals and (2) wine grapes, which are used only for the creation of wine. The leaves, as well as the fruit, are the greatsource of vitamins and minerals.Grapes were used as traditional medicine treatments, highlighting laxative, astringent, diuretic, cicatrisant, immunological stimulant, anti-inflammatory, and hypocholesterolemic activities.In a study Dogan and Celik reported that the grape juice, could be an important antioxidant supplement in the diet for the prevention of oxidative damage to tissues, by reducing lipoperoxidation or inhibiting the production of ethanol induced free radicals{11}, Gürocak conducted a new study and principal objective of his study was evaluate that are grapes capable to protect liver tissues against AOM (a chemical carcinogen).He reported that resveratrol a tannin found in grapes were most likely to give protective effects against the oxidative damage caused by chemical carcinogens, AOM.

Opuntiaficus-indica

Opuntiaficus-indicawhich is also know as Cactus pear fruit, Nopal and prickly pear, from the family Cactaceae. It found throughout the American continent, in the central zone of the Mediterranean, Europe, Asia, Africa, and Australia.it is usas a treatment for different pathologies, such as ulcers, dyspnea and glaucoma, as well as for liver diseases, wounds, and fatigue. Some preparations of the cladodes(known as fleshy stems) have been tested for the treatment of the symptomatology of diabetes in humans and in animal models,but the very first scientific evidence of Opuntiaficus-indica against hepatotoxic substanceswas described by Wiese{12 }.He reported that this cactaceous species was useful for reducing the symptoms of hangovers after consuming alcohol in excess,Opuntiaficus-indica could perish nausea, dry mouth, and anorexia, which are characteristic signs of alcoholic hangovers in humans.Later on, Ncibi {13} demonstrated that an extract of Opuntiaficus-indica cladodes could reduce the hepatic toxicity of the organophosphorous insecticide chlorpyrifos (CPF). The author reported that, combining CPF plus CCE could significantly normalize biochemical parameters, such as ALAT, ASAT, ALP, LDH, cholesterol, and albumin, in contrast with animals treated with the pesticide alone.{12}

Berries

These fleshy, juicy, small fruits which are habitually consumed all over the world but mostly in North America for example blackberries,raspberries, strawberries , blueberries, and cranberries

In 2007 International Berry Health Benefits Symposium, diverse research from Asia, Europe, New Zealand, Mexico, and North and South America demonstrated the potential benefits of consumption of berries, it was concluded that these benefits could be observed in cardiovascular diseases,neurodegenerative diseases, and other diseases associated with aging, in obesity, and in some human cancers.Wang to evaluate the effects of the blue berry on liver protection and cellular immune function. The author reported that treatment with this fruit significantly increased the expression of Nrf2, HO-1, and Nqo1, as well as the percentages of the CD3+ and CD4+ T lymphocyte subsets. On otherhand the spleen index got increased, improving the proliferation of lymphocytes deriving from this organ, increasing hepatic SOD, and reducing MDA. Author suggested that consuming this Blue berries protected hepatocytes from Oxidative stress and could modulate the function of T cells.it is important to know that the anthocyanins and proanthocyanidins are widely available compounds in fruits, vegetables, and seeds and so Shin studied the protective effects of proanthocyanidinsderived from cranberries, as well as from other fruits against DMN-induced hepatic lesions in rats.proanthocyanidins are a class of phenolic compounds that have demonstrated a broad range of biological effects.the author reported that these phenols showed hepatoprotective effects in vivo and antifibrogenic effects against DMN-induced hepatic lesions.

Ginger

(*Zingiber officinale*) belongs to the family zingiberaceae. It is an annual flowering plant, its rhizome is called ginger and it is widely used as a spice and folk medicine . It comes from then zingiberaceae family which curcuma longa, cardamom, and galangal . The major constituents in ginger rhizomes are carbohydrates (50–70%), lipids (3–8%), terpenes, and phenolic compounds. Terpene components of ginger include zingiberene, β-bisabolene, α-farnesene, β-sesquiphellandrene, and α-curcumene, while phenolic compounds include gingerol, paradols, and shogaol. Ginger possesses a range of biological activities such as Antioxidant, anti-inflammatory, antimicrobial ,anticancer ,neuroprotective cardiovascular protective, antiviral properties. Experiment was performed to determine the hepatoprotective effects of *Zingiber officinale against paracetamol induced hepatotoxicity* in rats Different groups of rats were given ginger in three doses 100,200 and 400 mg /kg at 12 hours intervals for 48 hours before the single paracetamol dose which was 640 mg /kg , another group of rats were given silymarin 25mg/kg which is been used as hepatoprotective drug in present. Blood of the rats were obtained from orbital plexus for the determination of various liver enzymes alanine aminotransferase (ALT), alanine aminotransferase (AST), alkaline phosphatase (ALP) and total bilirubin after that rat were sacrificed and the livers were excised for the histopathological study in which the examination of liver tissue for rat treated with paracetamol and ginger extract at dose of 100,200,400 mg/kg and also with silymarin revealed normal hepatic functions. After the last dose of treatment of all rats , blood was obtained from the retro-orbital plexus of veins. To perform tests for AST,ALT,ALP. Histopathological examination of liver tissues of rats treated with paracetamol showed partially disturbed lobular functions, show mild periportal fibrosis, hepatic parenchyma showed also distortion of liver cell plates particularly around central hepatic veins which demonstrated endothelitis, congestion, engorgement with RBCs and mononuclear inflammatory cells and hepatocytes showed scattered foci of spotty necrosis and minimal steatosis, perivenular hepatocytes exhibited hydropic degeneration, swelling and ballooning of hepatocytes .Examination of liver tissue of rats treated with paracetamol and ginger extract at dose "200 mg/kg" showed better liver functions, with low level of liver fibrosis. Ginger reduced serum ALT,AST and ALP indicating membrane stabilization and antioxidant properties of ginger.
we can conclude that ginger appears to be a herb that can be used for hepatoprotection this hepatoprotective effect of ginger may be due to the antioxidant properties of ginger{23}

Nigella sativa:

Nigella sativa also known as **black cumin**, **nigella** or **kalonji** is an annual flowering plant*Nigella sativa* is a small black seed that comes from a flowering plant in the *Ranunculacea* family. It is now been cultivated throughout India, the Middle East, and Europe.

Nigella sativa and its compounds have many biological effects such as anti-inflammatory, anti-hyperlipidemic, anti-microbial, anti-cancer, anti-oxidant, anti-diabetic, anti-hypertensive, and wound healing activities. Also *N. sativa* has the effects on reproductive, digestive, immune and central nervous systems. It can be used as a valuable plant for production of new drugs for treatment of many diseases.Oxidative stress is one of the main causes of liver injury that depletes the antioxidant enzymes sources and decreases the ability of cells in functioning against injury.Glutathione is highest in our liver and kidney, our main organs of detoxification, and by binding to the toxins in our body with an enzyme called conjugase, glutathione does help the liver to do its job of detoxification.Glutathione supports in both phase 1 and phase 2 reaction of detoxification.

A test was performed by 1 J. Danladi, 1A. Abdulsalam, 1 J. A. Timbuak, 2 S. A. Ahmed, 2Mairiga A.A, and 1A.U. Dahiru to check the Hepatoprotective Effect of Black Seed (Nigella sativa) oil on Carbon Tetrachloride (CCl4) Induced Liver Toxicity in Adult Wistar rats. In the experiment a total of 35 rats were used in the study .Rats were administered normal Saline (volume per body weight) orally for 2 weeks. Rats were administered olive oil 4ml/kg body weight orally for 2 weeks. Rats were administered 2ml/kg body weight of N. sativa oil orally for 2 weeks ,Rats were administered 4ml/kg body weight of N. sativa oil orally for 2 weeks ,Rats were administered 4ml/kg body weight CCl4 orally for 2 weeks. rats were administered 2ml/kg body weight of N. sativa oil +4ml/kg body weight orally for 2 weeks. rats were administered 4ml/kg body weight of N. sativa oil plus 4ml/kg body weight CCl4 orally for 2 weeksTreatment of animals with CCl4 is known to cause severe hepatic injury It was reported that CCl4 is suitable to induce lipid peroxidation in experimental animals within a few minutes after administration and its long-term use results in liver fibrosis and cirrhosis by lipid peroxidation pathway (Sherlock, 1970). It is generally thought that CCl4 toxicity is due to reactive free radical (CCl3), which is generated by its reductive metabolism by hepatic cytochrome P450. The reactive intermediate is believed to cause lipid peroxidation and breakdown of cellular membranes (De Groot et al., 1989). It was found that the oil of N. sativa has antioxidant effect greater than thymoquinone which is its active constituent (Houghton et al., 1995). N. sativa has antioxidant activity by suppressing the chemiluminescence in phagocytes (Haq et al., 1995). Recently, Turkdogan et al., 2003 observed that N. sativa has a significant hepatoprotective effect in CCl4-administrated rabbits. However, Turkdogan et al., 2001 found that N. sativa can prevent liver fibrosis and cirrhosis, suggesting that N. sativa protects liver against fibrosis possibly through immunomodulator and antioxidant activities. In this study, they found that N. sativa treatment alone showed normal LPO, antioxidant enzyme and liver enzyme levels as that of the control and also increased the reduced antioxidant enzyme levels in CCl4-treated rats. Previously performed clinical and experimental investigations have shown that N. sativa has a protective effect against oxidative damage in isolated rat hepatocytes (Daba and Abdel-Rahman, 1998). The biochemical results demonstrated that N. sativa treatment prevented CCl4-induced hepatotoxicity in rats by decreasing the lipid peroxidation and increasing the antioxidant defense system activity. However, Kanter et al., 2003 also showed the N. sativa increased the antioxidant defense system activity in experimentally CCl4-treated rats

In conclusion, N. sativa decreased lipid peroxidation and liver enzymes, and increased antioxidant defense system activity in the CCl4-treated rats

green tea (Camellia sinesis):

Camellia sinesis belongs to the family Theaceae the leaves and buds of this plant in used in making tea it is a species of evergreen shrubs or small trees in the flowering plant family Theaceae.. The typical phytochemicals found in tea are epigallocatechin gallate, flavonoids, tannins, caffeine, polyphenols, boheic acid, theophylline, theobromine, anthocyanins, gallic acid.. Due to the tannins present in tea it can bind with proteins, tea is used for its anti-diarrhoeal effect. The tannins have also antioxidant, diuretic and anti-cancer activity. C.siensis seems to inhibit the absorption of cholesterol. The best know effect of tea is the stimulating effect caused by caffeine. Caffeine affects adensine receptors and blocks the enzyme phosphodiesterase. Experiment was undertaken to examine the inhibitory effect of the green tea (Camellia sinesis) on cadmium chloride induced hepatoprotective activity in liver. Adult male albino rats were injected with cadmium chloride, to observe the activities of serum glutamate oxaloacetate transaminase (SGOT), serum glutamate pyruvate transaminase (SGPT), lactate dehydrogenase (LDH), γ-glutamyl transferase (GGT). The animals were randomly divided in various group then Toxicity was induced in a group of rats by administration of Cadmium chloride 1.25 mg/kg body weight by intraperitonial administration, and the other group was administered with 1.5% Camellia sinesis and Cadmium chloride. . In cadmium chloride injected rats (Group-III), the activities of SGOT, SGPT, LDH and GGT were seen significantly ($p < 0.05$) increasing, The rats administrated with cadmium chloride and green tea extract were showing significant ($p < 0.05$) decreased levels of serum SGOT, SGPT, LDH and GGT. Administration of green tea extract significantly reversed the cadmium chloride induced changes in circulation towards near normal.

We can conclude that Camellia sinesis shows hepatoprotection against Cadmium chloride indudced toxicity in Adult male albino rats.{21}

Mimosa pudica :

Mimosa pudica (word pudica means shy, bashful / shrinking in latin) known as Chue Mue in Hindi,and also called sensitive plant, sleepy plant, action plant, touch-me-not, shameplant M.pudiac is a stout stragling prostrate shrubby plant. which gets sensitive on touching Leaves and stem of the plant have been reported to contain an alkaloid mimosine, leaves also contain mucilage and root contains tannins. It majorly possesses antibacterial, antivenom, antifertility,

anticonvulsant, antidepressant, aphrodisiac, and various other pharmacological activities.

Mimosa pudica is used for its anti-hyperglycemic, antidiarrhoeal, fever, piles, jaundice, leprosy, ulcers and small pox.109 Histopathological studies revealed that the M. pudica extract exhibited protection of the liver tissue with the improvement in cellular morphology

R. Kowsalya and K.A. Sangeetha(Plant Archives Vol. 20, Supplement 2, 2020 pp)

A test was performed by R. Kowsalya nd K.A. Sangeetha to check the hepatoprotective activity of ethyl acetate of M.Pudica leave induced against paracetamol induced in albino rats.In the experiment a total of 20 rats were used in the study

The rats were divided in to groups as follo0wing : Normal control rats, Paracetamol control rats ,Mimosa pudica + Paracetamol , Normal rats treated with Mimosa pudicae. The paracetamol powder was administrating at concentrations of 100mg/kg was dissolved in distilled water given to rats through oral incubations for a period of 7 days .Dried and powder leaf sample was successively extracted with ethyl acetate the extracts were filtrated and concentrated using vacuum distillation. The different solvent extracts were subjected to quantitative tests for the identification of various Phytochemical constituents per the standard procedure. When preliminarily qualitative Phytochemical analysis was performed on leaves of ethyl acetate solvent extract of Mimosa pudica showed the presence of compounds Alkaloids, Flavanoids, Glycosides, and Carbohydrates the anlaysis also showed the absence of compounds like Steroids, Tannins, Amino acid, Phenols, Phytosterols and Proteins.

Histopathological studies were performed for the estimation of the resultrs.

In the Control rats liver was showing normal hepatocytes with uniform sinusoidal space. In the paracetamol-induced rats , nearly 50% Liver was showing severe disruption of hepatic cords, massive necrosis of hepatocytes, and wide distension of sinusoidal space around the central vein In the paracetamol + Mimosa pudica Extract sample induced rats 50% Liver showing moderate vacuolar degeneration and mild congestion of central vein suggesting the moderate efficacy of the extract. The Mimosa pudica extract sample induced rats ½ liver showing the normal pattern of hepatic cords with mild vacuolar degenerative change. The methanolic extract of leaves of Mimosa pudica was studied for the hepatoprotective effect using Peracetamol induced liver damage in wistar albino rats.

In the present study, oral administration of ethyl acetate extracted of Mimosa pudica leaves significantly prevented the bilirubin in paracetamol painted albino wister rats, which indicates its potent hepatocellular damage in experimental hepatoprotective activity Mimosa pudica leaves not only prevented the hepatoprotective formation but also inhibited the abnormal synthesis of hepatocellular damage as evidenced by decreased levels of tissue damage in paracetamol + Mimosa pudica treated rates. The modulating effect of Mimosa pudica on cellular damage in hepatitis could probably be due to its inhibitory role in hepatocellular synthesis or on the activity of the hepatocellular. The present study thus demonstrates the protective efficacy of Mimosa pudica leaves on abnormal hepatocellular tissue expression during paracetamol induced oral hepatoprotective activity. {17}

Dates (Phoenix dactylifera Linn)

Phoenix dactylifera L. belongs to the family Arecaceae, called “Nakhla” genus Phoenix that consist of 12 species mainly from tropical Asia and Africa. Phytochemically, the whole plant contains carbohydrates, alkaloids, steroids, flavonoids, vitamins and tannins. Four phenolic acids and nine bound phenolic acids were tentatively identified It possesses various medicinal properties like antioxidant,anticancer, antihypertensive, anitdiabetic,anti-inflammatory and hepatoprotective. Experiments were performed on rats. The first experiment was run to determine the hepatoprotective activity of date palm pollen grains .Twenty five Wister albino rats were baught and they were divided randomly to 5 groups of 5 rats each. The rats were allowed one week adaptation period. The controlled group of rats were given carbon tetrachloride (CCL4) subcutaneous injection in equal volume of olive oil (1:1) to induddde toxicity and the other group were given CCl4+250 mg/kg pollen grains powder. Histopatological studies were performed to see the changes in rats liver. The group treated with CCL4 concluded that the liver showed fatty changes, congestion and adhesion in the lobes and the group treated with CCl4+250 mg/kg pollen grains powder showed no post-mortem changes were observed in the vital organs. The rats treated with CCl4 only , showed that the serum Alanine amino transferase (ALT), Aspartate amino transferase (AST), Alkaline phosphatase (ALP) and the concentrations of total protein and albumin were significantly ($p< 0.05$) increased when compared with the untreated control group. Treatment with date palm pollen grains powder to rats in the other group (250 mg/kg and 500 mg/kg CCl4) resulted in significant ($p < 0.05$) fall in the levels of the enzymes ALT, AST and ALP and in the concentrations of total protein and albumin compared with CCl4 control group. The dates pollens which were used in this

study provided hepatoprotection against CCL4 at the dosed of 250mg/kg body weight. This effect may be due to the antioxidant properties of this plant {22}

curcuma longa :

Curcuma longa is a member of the ginger family (Zingiberaceae). Its rhizomes (underground stems) are the source of a bright yellow spice and dye. commonly known as "turmeric" The name possibly is been derived from Middle English or Early Modern English as *turmeryte* or *tarmaret*. It may be of Latin origin, *terra merita* ("meritorious earth").Recent studies have also shown that the taxonomy of *Curcuma longa* is problematic because there is only one specimens from South India being identifiable as *C. longa* The exact origin of Curcuma longa is not known, but it is thought to originate from South or Southeast Asia , most probably from Vietnam, China or western India various species currently utilized and sold as "turmeric" in other parts of Asia have been shown to belong to several physically similar
Phytochemical constituents: Turmeric powder is about 60–70% carbohydrates, 6–13% water, 6–8% protein, 5–10% fat, 3–7% dietary minerals, 3–7% essential oils, 2–7% dietary fiber, and 1–6% curcuminoidsPhytochemical components of turmeric include diarylheptanoids(a class including numerous curcuminoids, such as curcumin, demethoxycurcumin and bisdemethoxycurcumin, Curcumin constitutes up to 3.14% of assayed commercial samples of turmeric powder (the average was 1.51%); curry powder contains much less (an average of 0.29%). Some 34 essential oils are present in turmeric, among which turmerone, germacrone. atlantone and zingiberene are major constituents.

A test was performed by . CT. Sadashiva*, H.M. Firoz Hussain and S. Nanjundaiah to check the hepatoprotective activity of curcuma longa ,induced against paracetamol induced in albino rats.In the experiment a total of 30 rats were used in the study They were randomly divided into groups normal controlled rats, distilled water + paracetamol , silymarin + paracetamol , turmesac + paracetamol Curcumin supplementation at doses of 50 and 100 mg/kg/day to experimental rabbits with paracetamol induced hepatotoxicity lowers the elevated aspartate, alkaline phosphatase and alanine transaminase levels and raises the total protein and albumin levels in plasma. In addition to these changes, curcumin increased the levels of red blood cells and platelets. In another study, the efficacy of curcumin to manipulate the protein content, Succinate dehydrogenase , Thiobarbituric acid reactive substances , Adenosine triphosphatase activity, alkaline phosphatase activity, acid phosphatase activity , SOD and body weight of chloroquine phosphate induced hepatotoxicity was observed in a rat model. Therefore, this study has been conducted to evaluate the hepatoprotective activity of Turmesac on paracetamol induced hepatotoxic in rats. rats were showing normal histological functioning of liver with central vein and radiating chords of hepatocytes , rats were showing massive coagulative necrosis hemorrhage and inflammation , rats were showing partial centrizonal protection , rats were showing almost complete protection of hepatocytes against paracetamol induced hepatotoxicity . GroupV rats were showing almost normal functioning of liver with few fatty vacuoles.

It can be concluded from the present study that the Turmesac® possesses hepatoprotective activity against paracetamol induced hepatotoxicity in a rat model. Turmesac® has demonstrated hepatoprotective activity based on biochemical parameters Further investigation into these promising protective effects of Turmesac against paracetamol drug induced liver injury may have a considerable impact on developing clinically feasible strategies to treat patients with hepatotixicity.{18}

Table 1. Medicinal Plants with hepatoprotective activity.

Sr.No	Name of the Plant	Family	Plant parts used	Extract used	Hepatotoxicity inducing agents	Biochemical and histopathological parameter studied
1	Apiumgraveolens	Apiaceae	Seeds	Methanol	CCl4	SGOT, SGPT, SALP, TP, TA, and GSH
2	Canna indica	Cannaceae	Aerial parts	Methanol	CCl4	SGPT, SGOT, TB, CAT, GSH, LPO
3	Ficuscordata	Moraceae	Roots	Methanol/ethyl acetate	CCl4	LDH
4	Clausenalansium	Rutaceae	stem bark	Methanol	CCl4	Reduction in phenobarbitone, sleeping time and serum liver protein, serum AST, ALT, and ATP
5	Rosa damascena Mill	Rosaceae	Flower	Aqueous	Acetaminophen	AST, ALT, ALP, LDH, ALBTB, urea and creatinine, TBARS, and GSH
6	Allium cepa	Liliaceae	Fresh bulbs	Aqueous	Ethanol	ALT, ALP, AST, and TB
7	Hibiscus rosasinensis	Malvaceae	Flower	Aqueous	Mixture of cholesterol and cholic acid with coconut oil	AST, ALT, ALP
8	Alcearosea	Malvaceae	Aerial parts	Aqueous methanol	PCM	TB, DB, ALP, and AST
9	Loranthus	Loranthaceae	Leaves	Ethanol	D-galactosamine and CCl4	SGPT
10	Tecomella Undulate	Bignoniaceae	Aerial parts	Aqueous/ ethanol	PCM	AST, GSH, SGOT, SOD, SPGT, CAT, GSH-Px, GST, ALP, and ALT
11	Scopariadulcis	Scrophulariaceae	Leaves	Ethanol	CCl4	SGPT, TB, ALT, ALP, SGOT, and AST
12	Saururus Chinensis	Saururaceae	Whole plant	Ethanol	CCl4	AST, ALT, ALP, CHL, SOD, CAT, MDA, and GSH
13	Ipomoea Staphylina	Convolvulaceae	Leaves	Hydroalcohol	CCl4	ALP, SGOT, AST, CHL, ALT, SGPT
14	Fraxinus rhynchophylla	Oleaceae	Stem barks	Ethyl alcohol	CCl4	ALT, AST, MDA, SOD, GSH, and GSH-Px

Sr.No	Name of the Plant	Family	Plant parts used	Extract used	Hepatotoxicity inducing agents	Biochemical and histopathological parameter studied
15	Ziziphus Mucronata	Rhamnaceae	Leaves	Methanol	Dimethoate	SGOT, TBARS, SGPT, GSH, SOD, tocopherol, HDL, LDL, CHOL, TL, TGA
16	Bidenspilosa	Asteraceae	Dried aerial parts	Ethanol	CCl4	AST, ALT, and LDH
17	Antrodiacinnamomea	FomitopsisDeae	Fruiting bodies and mycelia	Aqueous extract and ethano	CCl4	induced elevation of expression of hepatic mRNAs, i.e., MMP-9, TNF-α, KLF-6, and TGF-β1 Levels
18	Oxalis corniculata	Oxalidaceae	Whole plants	Ethanol	PCM	SGOT, SGPT, and ALP
19	Bauhinia racemosa Lam	Fabaceae	Bark	Methanol	CCl4 and PCM	SGPT, SGOT, SOD, GSH, and TBARS
20	Tephrosia Purpurea	Fabaceae	Root	Ethanol	CCl4	Induce apoptosis of hepatic stellate cells (HSCs)
21	Cyperusrotundus	Cyperaceae	Leaves	Methanol	CCl4	SGOT, SGPT, ALP
22	Cestrum	Solanaceae	Leaves	Aqueous	PCM	SGOT, SGPT, ALP, AST, ALT, and LDH
23	Rumexdentatus	Polygonaceae	Whole plant	Aqueous/ methanol	PCM	ALP, ALT, TB, and AST

II. CONCLUSION

From the present review, it can be concluded that herbal medicinal plants and its derivatives are active against different Hepatotoxicity inducing agents like CCl4 , Cadmium chloride and PCM, etc The cheap herbal drug treatment may highly be recommended to the rural and poor people to treat effectively. This review has shown that plants like Nigella Sativa ,Mimosa Pudica, Curcuma longa, Grape fruit, Spirulina,& Tulsi dates,ginger,green tea, grapes, berries,Nopel etc. which were used in ayurveda possess hepatoprotective activity. This review reveals the role of medicinal plants and the various phytochemicals may be treated effectively against hepatotoxicity . In an attempt of screening the traditional medicinal plants for hepatoprotecive activity the presence of several bioactive compounds such as flavonoids, polyphenols, saponins, etc. with specific hepatoprotective activity against particular type of toxicity hence the huge space is available for development of potent hepatoprotective agents from plant derivatives.

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