CHAPTER 2

REVIEW OF LITERATURE
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AkramEidi et al., (2012) has studied the protective effect of Cinnamon bark extract against CCl₄ induced liver damage in male wistar rats. They administered dose 0.01, 0.05 & 0.1g/kg for 28 days which reduced the levels of AST, ALT, ALP. They also resulted in markedly increased the level of SOD, Catalase (COT) enzymes in rats.

Amin et al., (2005) has studied the hepatoprotective effect of Hibiscus, Rosmarinus and salvia on azathioprine induced toxicity, where they had studied azathioprine induced oxidative stress through depleting activities of antooxidants and elevating levels of malonaldehyde in liver along with escalation of AST, ALT in serum. Pretreatment with these three plants had shown protection.

Bishayi et al., (2002) has testified the hepatoprotection and immunomodulatory properties of Tinospora Cardifolia in CCl₄ intoxicated mature albino rats by estimation of enzymes SGPT, SGOT, ALP and bilirubin levels and Immunomodulation by macrophages assay and phagocytic index and neutrophil adhesion.

Chakraborthy G.S. et al., (2009) has done work on immunomodulatory effect of Aesculus indica in rats, they administered oral doses of 50 &100mg/kg to healthy rats which are divided into 5 groups containing 6 in each and assessment of immunomodulatory activity was tested. The study stated that
Aesculus indica should. Significant stimulation of the cell mediated immunity and no effect on humoral immunity.

**Dashputre et al., 2010** studied Immunomodulatory activity of *Abutilon Indicum Linn* on Albino mice, ethanolic and aqueous extract of leaves showed significant increase in the haemagglutination antibody titer, delayed type of hyper sensitivity response, neutrophils adhesion test and carbon clearance test and confirmed *Abutilon Indicum Linn* to show specific and non specific responses to a greater extent and Immunomodulatory activity is attributed to the Flavonoid content.

**Doss et al., (2010)**, had identified the flavonoid and determined the flavonoid content from the extracts. The antioxidant activity of under-utilised legume seeds of *Canavalia ensiformis* and *Canavalia gladiata* was evaluated by DPPH free radical scavenging assay. Ascorbic acid was used as standard and positive control. *Canavalia gladiata* with IC50= 59.23 had shown the highest radical scavenging activity.

**Gowrishankar et al., (2008)** evaluated hepatoprotective and antioxidant effect of *commiphera berryi* Engl bark extract against CCl4-oxidative damage in rats. CCl4- oxidative damage has showed a marked increase in the serum levels of AST, ALT, ALP and bilirubin due to liver cell necrosis and confirmed to increase the levels of SOD GPx and CAT and by treatment with *C. berryi* has normalized various biochemical parameters and was compared with silymarin.
Fulzele et al., 2002 studied Immunostimulant activity of Ashtamangal Ghrita in rats, a polyherbal formulation showed significant increase in neutrophil adhesion, haemagglutinating antibody titer and delayed type hypersensitivity response in test compared with control group.

Gokani et al., 2007 studied Evaluation of Immunomodulatory activity of Clerodendrum phlomidis and premna integrifolia root, methanolic extract of roots showed significant increase in haemagglutinating antibody titer, plaque forming cell assay, Delayed type hypersensitivity response, carbon clearance test and immunoprophylactic effect with Escherichia coli (0.5ml/kg). Clerodendrum phlomidis showed higher specific immune activity as compared to premna integrifolia root.

Hesham et al., (2010) Azathioprine (AZA) is an immunosuppressant that has been used in the treatment of several diseases although AZA has been reported to be hepatotoxic. In the current study, the protective effects of green tea (Camellia sinensis) extract (GTE) against AZA-induced hepatotoxicity in rats were evaluated. A group of rats were given 1.5 % GTE orally 7 days pre and 14 days post AZA-intoxication as the sole source of drinking water and histopathological investigations of the liver were performed on all the study groups. AZA administration to rats resulted in elevation of serum transaminases (sALT and sAST). The results in inhibition of the hepatic activity of superoxide dismutase (SOD) and catalase (CAT). Furthermore, AZA
treatment increased the hepatic levels of tumor necrosis factor-alpha (TNF-α) and myeloperoxidase (MPO) and MPO levels and improved the different histopathological changes following AZA intoxication. The results of this study showed that, GTE could produce a significant protective effect against AZA induced liver damage via potentiating the antioxidative pathways and inhibiting the neutrophil infiltration pathways in rats\textsuperscript{31}.

Ignacimuthu et al., 1998 studied Effect of Leaf Extract of Zizyphus jujuba on Diabetic rats, aqueous extract of leaves showed hypoglycemic effect by decreasing the levels of blood glucose, urea, serum cholesterol, triglycerides and phospholipids in normal and diabetic rats\textsuperscript{32}.

Kalpesh et al., 2009 studied Comparative Screening of Immunomodulatory Activity of Hydro-alcoholic Extract of Hibiscus rosa sinensis Linn. Showed significant increase in haemagglutinating antibody titer and delayed type hypersensitivity response occurred by immunosuppresion with Cleome gynandra Linn. And immunostimulatory activity is observed with Hibiscus rosa sinensis Linn\textsuperscript{33}.

Kallakunta Ruth Salomi et al., (2011) has done study to evaluate the immunomodulatory property of petroleum ether extract of seeds of Celastrus paniculatus on immunological, hematological and oxidative stress parameters using pyrogallol induced immunosuppression
models in rats. The results suggested that PECP stimulates humoral immunity by increase in antibody titre and cell mediated immunity\textsuperscript{34}.

**Mahuya Sengupta et al., (2011)** has evaluated the Hepatoprotective and immunomodulatory properties of aqueous extract of *curcuma longa* in carbon tetra chloride intoxicated swiss albino mice. The levels of SGPT, SGOT and bilirubin levels were estimated in serum for hepatoprotection and morphological alterations, phagocytosis for immunomodulation\textsuperscript{35}.

**Neelam et al., 2010** studied Preliminary Immunomodulatory Activity of Aqueous and Ethanolic Leaves Extract of *Ocimum basilicum Linn* in Mice, shown very significant immunostimulating agent against cyclophosphamide induced immunosuppresion in mice by increasing haemagglutination antibody titer, delayed type of hyper sensitivity response, neutrophil adhesion test and carbon clearance test\textsuperscript{36}.

**Nilima. S. Pawar et al., (2012)** Protective effect of a polyherbal mixture was evaluated for their hepatoprotective activity against ferrous sulphate and ethanol intoxication. Biochemical estimations for AST, ALT, ALP, Total bilirubin and Total protein were carried out at the end of treatment schedule for respective models. The mixture of *Picrorhizakurrao, Embilica officinalis, Andrographis paniculata, Eclipta alba* to constitute total doses T50 mg was prepared. The hepatoprotective effects polyherbal mixture were estimated by liver function test and serum profile. The results revealed that polyherbal
mixture produced significant hepatoprotective effect by decreasing serum transaminase like AST, ALT, ALP (alkaline phosphatase) and total bilirubin, but also significantly increased the levels of total protein. Morphological parameter like liver weight was restored by the polyherbal mixture. The effects of polyherbal mixture were comparable with standard drug silymarin$^{37}$.

Satyanarayana et al., (2009) has studied the hepatoprotective effect of alcohol extract of Capparis sepiaria stem against in CCl$_4$ albino rats, the rats were pretreated with alcohol extract and standard silymarin rats for 7 days and concluded that the extract produced. Significant reduction in the elevated levels of AST, ALT, TB and rise of decreased total protein level is observed and inferred$^{38}$.

Savadi et al., (2009) conducted study using ethalonic extract of the leaves of Spilenthes acmella Murr for evaluating Immunomodulatory activity by different models like modulation of macrophage function, carbon clearance assay with the help of Indian ink dispersion in mice and immune prophylactic effect with the help of E. coli in mice and from the results reveled that it exhibits significant peritoneal macrophage stimulation$^{39}$.

Sankari et al., 2010 studied Immunosuppressive activity of aqueous extract of Lagenaria siceraria (standley) in mice, showed significant decrease in haemagglutinating antibody titer and delayed type hypersensitivity response in test compared with control group$^{40}$.
**Suresh Gupta et al., 2006** studied Immunomodulatory Activity of the Ayurvedic Formulation “Ashwagandha Churna” in rats, showed significant increase in delayed type hypersensitivity response and neutrophil adhesion in test compared with control group\(^{41}\).

**Sharififar et al., 2009** studied Immunomodulatory Activity of Aqueous Extract of *Heracleum persicum* Des. In Mice, a medicinal plant an aqueous extract of the fruits showed increase in relative organ weight of spleen and liver, significant increasing in haemagglutinin titer assay, delayed type of hyper sensitivity response and no mortality occurred with the test dose\(^{18}\).

**Vaghasiya et al., 2010** studied Comparative evaluation of Alcoholic and aqueous extracts of *Ocimum Sanctum* for Immunomodulatory activity, showed significant stimulatory effect on the humoral and delayed type hypersensitivity and alcoholic extract was potent than aqueous extract\(^{19}\).

**Venkatachalam et al., (2009)** Conducted experiment using Aqueous leaf extract of *Morus alba* for the immunomodulatory activity using Wistar rats as the specimen and tested for hypersensitivity and hemagglutination reaction using sheep red blood cells (SRBC) as the antigen. The *Morus alba* (200 & 400 mg/kg p.o) it offers an increase in delayed type hypersensitivity reaction whose effect is comparable with that of the standard drug levamisole and also does not induce any significant alterations in antibody titer value. It also facilitates a
considerable increase in total leukocyte, lymphocyte, neutrophil and eosinophil count, and was also found to induce a better immunomodulatory activity and thus revealed that Morus alba aqueous extract stimulates the innate or nonspecific immune system in a dose dependant manner and does not stimulate the adaptive immune system in mediating immunomodulatory property\textsuperscript{12}.