LITERATURE REVIEW

Literature review for undertaking the study was done by referring to various national and international journals, published articles in various official standard books and referring to various websites on the internet.

1. An attempt was made by Navarro et al describes the phytochemical analysis and analgesic activity of Curcuma zedoaria rhizomes grown in Brazil. The investigation showed that the hydroalcoholic extract, fractions, specially dichloromethane, and a pure compound, named as curcumenol, exerted potent and dose-related analgesic activity carried out using several models of pain in mice, including writhing, formalin and capsaicin. The results showed that the phytochemical analysis and analgesic activity confirm and justify the popular use of this plant for the treatment of painful processes. (15)

2. Maldini et al evaluated Phenolic compounds from B. simaruba Sarg. bark: Phytochemical investigation and quantitative analysis by tandem mass spectrometry. Phytochemical investigation of the methanolic extract of B. simaruba bark led to the isolation of 11 compounds and their structures were established by NMR and ESI/MS experiments. Additionally, an LC-ESI/MS qualitative study on the phenolic compounds and an LC-ESI/MS/MS quantitative study on the lignans carried out. The results indicates developed for lignan analysis was successfully applied to other lignan producing plants to quantify these bioactive compounds in raw material and final products. (16)

3. Patel et al reported the Physicochemical and phytochemical investigations of seeds of Celosia argentea Linn. Physicochemical parameters and preliminary phytochemical analysis, phytochemical and elemental analysis provides essential information which may be help in identification, authentication and adulteration for quality control of raw material. The study scientifically validates the use of plants in traditional medicine and phytochemical data will be helpful for the standardization and quality control of precious indigenous drug and also Pharmaceutical industries. (17)

4. Gelsomina et al demonstrated the Comparative phytochemical and morphological analyses of three Italian Primula species. The Phytochemical
investigations of the flavonoid composition of leaves, isolation and identification of two new flavonol glycosides are carried out. The results of morphologic and phytochemical markers proposed in this work seem to be parameters which significantly discriminate the species under study. (18)

5. Assam et al reported the In vitro antibacterial activity and acute toxicity studies of aqueous-methanol extract of Sida rhombifolia Linn. (Malvaceae) The acute toxicity study was performed according WHO protocol and antibacterial activity was carried out by inhibition diameters and the Minimum Inhibitory Concentration (MICs) respectively. The results showed that the extract of S. rhombifolia exhibited moderate antibacterial activity. Some toxic effects were found when rats received more than 8 g/kg bw of extract. (19)

6. Hoffmann et al investigated the acute oral toxicity: Variability, reliability, relevance and interspecies comparison of rodent LD50 data from literature surveyed for the ACuteTox project. Ninety-seven reference substances were selected and an in vivo acute toxicity database was compiled. The results indicated that for the majority of analysed substances the variability among rodent data followed a log normal distribution. The reproducibility of both rat and mouse LD50 data was found to be good. These results indicate the basis for deriving a predictive capacity that should be expected from alternative approaches to the conventional in vivo acute oral toxicity test. (20)

7. Kitamura et al investigated a sub-chronic toxicity study of shea nut color in Wistar rats. The sub acute toxicity study was carried out in Wistar Hannover rats for 13-week. During the dosing period, daily observation of clinical signs and weekly measurement of body weights and food consumption were performed. The results reported no significant toxicological changes were observed in any parameters in this study. (21)

8. Henderson et al demonstrated the acute oral toxicity of nickel compounds acute oral toxicity studies were conducted on samples of nine unique nickel compounds. The samples tested in this study confirmed the overall low oral toxicity of nickel substances and demonstrated a wide range of LD50 values. This study provides valuable data on the acute oral toxicity of eleven nickel-containing substances in rodents. In addition, the utility of these data in
developing an extensive read-across program for systemic toxicity is reported in companion manuscript. (22)

9. Rao et al investigated the toxicity studies in mice of Commiphora molmol oleo-gum–resin. Acute (24 h) and chronic (90 days) oral toxicity studies on Commiphora molmol (oleo–gum–resin) were carried out in mice. The study reported that acute toxicity test exhibited no visible signs of toxicity and no mortality was observed up to 3 g/kg dose level. However, some decrease in locomotor activity at a dose of 3 g/kg was noticed. In general, volatile oil are known to have depressant action on the central nervous system. (23)

10. Tona et al investigated antiamoebic and spasmylytic activities of extracts from some antidiarrhoeal traditional preparations used in Kinshasa, Congo. Aqueous traditional preparations from different plant species have been reported to have a positive effect against diarrhoea. The most active polyphenolic extracts were those from *Euphorbia birta* whole plant, *Nauclea latifolia*, leaves of *Alchornea cordifolia*, *Crossopteryx febrifuga*, *Tithonia diversifolia*, *Psidium guajava*, *Euphorbia birta*, *Nauclea latifolia*, *Alchornea cordifolia*, *Crossopteryx febrifuga*, *Tithonia diversifolia*, *Psidium guajava* and *Maprounea africana* inhibiting *Entamoeba histolytica* growth. The significant antiamoebic and spasmylytic activities displayed by some active extracts containing at least a characteristic phytochemical group such as polyphenols, saponins or alkaloids as major constituents was reported. (24)

11. Mazumder et al reported antibacterial activity of *Urena lobata* root. The methanolic extract of *U. lobata* root (125-1000 µg/ml) exhibited broad spectrum of concentration-dependant antibacterial activity against all tested bacterial strains except *Salmonella typhi*. (25)

12. Kumar et al Search for antibacterial and antifungal agents from selected Indian medicinal plants. A series of 61 Indian medicinal plants belonging to 33 different families used in various infectious disorders, were screened for their antimicrobial properties. Twenty-eight plant extracts showed activity against at least one of the test organisms used in the screening. On the basis of the results obtained, report concluded that the crude extracts of *Dorema ammoniacum*, *Sphaeranthus indicus*, *Dracaena cinnabari*, *Mallotus philippinensis*, *Jatropha gossypifolia*, *Aristolochia indica*, *Lantana camara*, *Nardostachys jatamansi*, *Salmonella typhi*. (25)
*Randia dumetorum* and *Cassia fistula* exhibited significant antimicrobial activity. This probably explains the use of these plants by the indigenous people against a number of infections. \(^{(26)}\)

13. Venkatesh et al demonstrated anti-diabetic activity of flowers of *Hibiscus rosasinensis*. The hypoglycemic effect of the ethanolic extract of *H. rosasinensis* flowers on the fasting blood sugar levels of alloxan induced diabetic rats showed significant reduction in the blood sugar level. It was suggested that the regeneration of β cells following destruction by alloxan might be the primary cause for the antidiabetic activity of the extracts. From these results, it was concluded that the present study seems to support the claims by traditional medicine practitioners about the usefulness of *H. rosasinensis* flower for the treatment of diabetes. \(^{(27)}\)

14. Seetharama et al investigated hypoglycemic activity of *Abutilon indicum* leaf extracts in rats. The rats were fasted for 18 h prior to experiment, with water ad libitum. Alcohol and water extracts of *Abutilon indicum* leaves 400 mg/kg, p.o. showed significant hypoglycemic effect in normal rats 4 h after administration. Flavonoids known to regenerate the damaged pancreatic β cells and glycosides stimulate the secretion of insulin in β cells of pancreas the presence of both in the active extracts may be responsible for their activity. \(^{(28)}\)

15. Morelli et al isolated triglycerides from *Urena lobata*. Two triglycerides, both bearing polyunsaturated fatty acid residues, were isolated from the hexane extract of *Urena lobata*. One triglycerides is characterized by the presence of three different polyunsaturated fatty acids. Their structures were studied with spectral methods. Isolation of compounds can be indicative of a propensity of the plant for the biosynthesis of triglycerides bearing different saturated and unsaturated fatty acid residues in the same molecule. \(^{(29)}\)

16. Graham et al reported antimycobacterial evaluation of Peruvian plants. The present study results of an antimycobacterial screening of 270 Peruvian plant samples, 216 species from 171 genera in 63 families. Dichloromethane extracts were tested at a concentration of 50 μg/ml for inhibition of *M. tuberculosis*. The finding results in lack of phytochemical investigation for many of these species, represents a unique collaborative research opportunity for investigators. \(^{(30)}\)
17. Damintoti et al investigated antimalarial activity of Sida acuta Burm. f. (Malvaceae) and Pterocarpus erinaceus Poir. (Fabaceae). Studies carried out for new antimalarial activities, four plants of the traditional medicine, were tested in vitro on fresh clinical isolates of Plasmodium falciparum. The screening showed among four plants Sida acuta has a significant activity and Pterocarpus erinaceus has a moderate activity. Further chemical screening showed that the activity of the most active plant, Sida acuta, was related to its alkaloid contents. (31)

18. Ballabeni et al demonstrated antiplatelet and antithrombotic activities of essential oil from wild Ocotea quixos (Lam.) Kosterm. (Lauraceae) calices from Amazonian Ecuador. This study is evaluated the potential antithrombotic activity of subacute treatment of mice with oil in acute thrombosis induced by collagen-epinephrine intravenous injection. Antiplatelet activity carried out by collagen-induced platelet aggregation and thrombin-induced clot retraction. Oil was shown to possess significant inhibitory activity of platelet aggregation and clot retraction in rodent plasma. The main constituent trans-cinnamaldehyde seems to be the primary responsible for this activity. (32)

19. Sutradhar et al investigated bioactive flavones of Sida cordifolia. Two new flavones: 5, 7-dihydroxy-3-isoprenyl flavone and 5-hydroxy-3-isoprenyl flavone, along with two known compounds b-sitosterol and stigmasterol have been isolated from the chloroform extract of Sida cordifolia. Their structures were established on the basis of spectroscopic analysis. Flavones were tested for their analgesic and anti-inflammatory activity. (33)

20. Ravishankara et al investigated evaluation of antioxidant properties of root bark of Hemidesmus indicus R. Br. (Anantmul). Above investigation carried out using several in vitro and ex vivo models, methanolic extract of H. indicus root bark was found to scavenge superoxide radical, nitric oxide radical, hydroxyl radical and inhibited the lipid peroxidation. The antioxidant activity of the extract can be attributed to the presence of tannins and other phenolic compounds. The free radical scavenging property may be one of the mechanisms by which this compounds is effective in traditional medicine. (34)

21. Dashputre et al reported immunomodulatory activity of Abutilon Indicum linn on Albino Mice. The Ethanolic and aqueous extracts assessed for
immunomodulatory activity on specific and non-specific immunity were studied by haemagglutination antibody (HA) titer, delayed type hypersensitivity (DTH), neutrophil adhesion test and carbon clearance test in cyclophosphamide induced immunosuppression in mice. The study demonstrated that A. indicum triggers both specific and non-specific responses to a greater extent and immunostimulatory effect could be attributed to the flavonoid content. (35)

22. Jayathirtha et al demonstrated preliminary immunomodulatory activities of methanol extracts of Eclipta alba and Centella asiatica. An attempt was made to assessed the immunomodulatory activity of methanol extracts of whole plant of E. Alba and C. asiatica at five dose levels using carbon clearance, antibody titer and cyclophosphamide immunosuppression parameters. The results findings are E. alba, the phagocytic index and antibody titer increased significantly and the F ratios of the phagocytic index and WBC count were also significant. (36)

23. Geetha et al evaluated anti-oxidant and immunomodulatory properties of seabuckthorn (Hippophae rhamnoides)—an in vitro study. This study was designed to determine ability of alcoholic leaf and fruit extracts of seabuckthorn to inhibit the oxidative damage induced by chromium was investigated. Chromium also caused a significant inhibition of lymphocyte proliferation induced by both lipopolysaccharide and concanavalin A. These findings suggested that the alcoholic extracts have marked cytoprotective properties, which could be attributed to the anti-oxidant activity and also have immunomodulating activity due to inhibition of lymphocyte proliferation. (37)

24. Shah et al evaluated anti-inflammatory, analgesic and antipyretic properties of Thespesia populnea Soland ex. Correa seed extracts and its fractions in animal models. Acute arthritis was induced by sub-planter injection of carrageenan into the left hind paw of rats. Analgesic activity was assessed by heat induced pains (tail immersion model) and antipyretic activity assessed using brewer’s yeast-induced pyrexia model. Based on the results, extracts showed potential significant antipyretic, anti-inflammatory and analgesic activity. GC–MS analyses showed the presence of fourteen fatty acids, predominant fatty acids were palmitic and stearic acid. (38)
25. Reddy et al reported antinociceptive activity of Malvastrum coromandelinum. The aerial parts of M. coromandelinum showed antinociceptive activity in the 0.6% acetic acid-induced writhing test in mice. Acetone and chloroform extracts of M. coromandelinum aerial parts showed significant antinociceptive activity. Phytochemical analysis of these two extracts indicated that steroids, triterpenoids may be attributed for the observed pharmacological activity. The obtained findings provide a support to some of the uses of the plant extracts in traditional medicine. (39)

26. Thounaojam et al demonstrated cardioprotective effect of Sida rhomboidea. Roxb extract against isoproterenol induced myocardial necrosis in rats. The present study investigated cardioprotective effect of extracts on heart weight, plasma lipid profile, plasma marker enzymes, lipid peroxidation, endogenous enzymatic and non-enzymatic antioxidants and membrane bound ATPases against isoproterenol (IP) induced myocardial necrosis (MN) in rats. This study validates traditional use of Sida rhomboidea extract for treating heart ailments thus confirming its folklore claim. (40)

27. Piemea et al evaluated In vitro cytotoxicity and antioxidant activities of five medicinal plants of Malvaceae family from Cameroon. The potential antiproliferative and antioxidant activities of extracts from five medicinal plants from Cameroon were evaluated in vitro on HepG-2 cells. The results showed the significant antiproliferative activity decrease of the viability of the cells in a concentration-dependent manner and exhibited weak cytotoxicity. The results of the antioxidant activity showed significant increase of SOD, CAT and GsT. The finding showed promising alternative to synthetic substances as natural compound with high antiproliferative and antioxidant activities. (41)

28. Ram et al demonstrated Medicinal plants useful for treating chronic obstructive pulmonary disease (COPD): Current status and future perspectives. The surveyed were segregated into two categories. Firstly, the plants which are used for obstructive lung diseases based on various traditional recommendations only. Secondly, the plants or their formulations which have been studied grossly in COPD patients and animal models for their scientific validation. Further, surveyed described some known cellular and molecular factors involved in
COPD and their modulation by plant-derived compounds. Certain future perspectives have also been discussed. \(^{(42)}\)

29. Rocha et al carried out a review of natural products with antileishmanial activity. The present work constitutes a review on plant extracts and chemically defined molecules of natural origin showing antileishmanial activity. The review findings 101 plants, their families, and geographical distribution, the parts utilized, the type of extract and the organism tested. It also includes 288 compounds isolated from higher plants and microorganisms, classified into specific chemical groups. Some aspects of recent antileishmanial-activity-directed research on natural products are discussed. \(^{(43)}\)

30. Mojiminiyi et al screened Antihypertensive effect of an aqueous extract of the calyx of Hibiscus sabdariffa. The present study was designed to investigate the efficacy of an aqueous calyx extract of Hibiscus sabdariffa (HS) in two experimental models of hypertension are salt-induced and L-NAME (Nω-L-arginine methyl ester)-induced and in normotensive controls. This study provided further experimental evidence that justifies the folkloric use of this plant in the treatment of hypertension. \(^{(44)}\)

31. Franco et al investigated CNS pharmacological effects of the hydroalcoholic. This work researched the acute toxicity of *Sida cordifolia* and its action on the central nervous system (CNS) was demonstrated by several alterations in mice’s behavior in the pharmacological screening. In the motility test, the HESc showed significant reduction of spontaneous activity and also decreased the ambulation and rearing in open-field test. On the basis of the present study, we may suggest that the HESc has depressant effect on CNS without interfering with motor coordination with a low toxicity, thus justifying its extensive use in traditional medicine. \(^{(45)}\)

32. Moujir et al demonstrated Cytotoxic activity of lignans from Hibiscus cannabinus. The antimicrobial and cytotoxic activities of six lignans isolated from the core and bark acetone extracts of Hibiscus cannabinus against HeLa, Hep-2 and A-549 cell lines while some lignans showed moderate activities. The compounds did not exhibit antimicrobial activity. \(^{(46)}\)
33. Wright et al. evaluated Herbal medicines as diuretics: A review of the scientific evidence. The review of these studies identifies which extracts promote diuresis and identified a number of species and genuses reporting diuretic effects. Of these, the most promising, at the present time, are the species Foeniculum vulgare, Fraxinus excelsior, Hibiscus sabdariffa, Petroselinum sativum and Spergularia purpurea, and genuses Cucumis, Equisetum, Lepidium, Phyllanthus and Sambucus. However, there the number of studies is limited and studies recommended that further studies be conducted to confirm reported effects. Such evidence is needed to provide scientific credence to the folklore use of traditional medicines. (47)

34. Noumi et al. reported Medicinal plants used for peptic ulcer in the Bangangte region, western Cameroon. For treating peptic ulcers thirty-nine traditionally plant species used in the Bangangte region and 47 species from 32 different families used for the treatment of peptic ulcers were recorded. Many of these records, particularly those concerning Acanthospermum hipidium, Canarium schweinfurthii, Corchorus olitorius, Delonix regia, Drymaria cordata, Ficus exasperata, Fluerya aestruans, Morus mesozygia, and Portulaca oleracea, are new to the literature of Cameroonian medicinal plants and some species useful in gastric diseases was recorded. (48)

35. Dashputre et al. evaluated anti-ulcer activity of methanolic extract of abutilon indicum Linn Leaves in experimental Rats. Here, present study was carried out to investigate antiulcer activity of methanol extract in pylorus ligated and ethanol induced ulceration in the albino rats. The acute oral toxicity study carried out according to the OECD guidelines. The methanolic extract of A. indicum leaves possess significant antiulcer properties in a dose dependent manner and may be attributed to the presence of phytochemicals like flavonoids (quercetin), alkaloids and tannins present in the plant extract with various biological activities. (49)

36. Kubavat et al. evaluated role of Sida cordifolia L. leaves on biochemical and antioxidant profile. Myocardial infarction was induced by administering isoproterenol (ISO) or by subjecting heart to ischemia reperfusion injury (IRI). Endogenous biomarkers (LDH and CK-MB) and antioxidants (SOD and catalase) were estimated in serum/perfusate and heart tissue homogenate (HTH).
Antioxidant effect of flavonoids present in HESC could be responsible for this cardioprotection. (50)

37. Nagappa et al evaluated wound healing activity of the aqueous extract of Thespesia populnea fruit. Villagers have traditionally used it to treat a variety of skin ailments including wounds. In the present study, the aqueous extract of T. populnea fruit showed significant wound healing activity in the excision wound and incision wound models in rats. The present study showed that T. populnea fruit aqueous extract possesses a good wound healing activity. (51)

38. Telefoa et al investigated oestrogenicity and effect on hepatic metabolism of the aqueous extract of the leaf mixture of Aloe buettneri, Dicliptera verticillata, Hibiscus macranthus and Justicia insularis. The aqueous extract given by oral route to immature female rats induced a significant increase in ovarian and uterine weight as well as serum and ovarian oestradiol. Study concluded that inductive effect of the studied extract is used in the treatment of some cases of infertility in women. (52)

39. Javanmardia et al evaluated antioxidant activity and total phenolic content of Iranian Ocimum accessions. Basil (Ocimum basilicum L.) is used in traditional medicine, as a culinary herb and a well-known source of flavouring principles. Total antioxidant activity in 23 Iranian basil accessions was determined. Total phenolic contents were determined using a spectrophotometric technique, according to the method of Spanos and Wrolstad. Iranian basils possess valuable antioxidant properties for culinary and possible medicinal use. (53)

40. Dahanukar et al demonstrated pharmacology of medicinal plants and natural products. Study showed a definite change in the pattern of research on medicinal plants. Present study findings are a growing interest in correlating phytochemical constituents of a plant with its pharmacological activity. In future, more co-ordinated multidimensional research aimed at correlating botanical and phytochemical properties to specific pharmacological activities is expected. Here, the authors have attempted to interpret the word ‘rasayana’ in modern terminology and have taken into consideration the advocated uses for this compounds of plants as per Ayurvedic books while designing their research protocol. (54)