SUMMARY

Summary of thesis or any in-depth analysis of a particular subject or discipline, and is often used to help the reader quickly ascertain the paper's purpose.
Summary

The medicinal plants played an important role in the discovery of new drugs. A lot of natural product was used as a pharmaceutical product in the treatment of the many diseases. Diabetes mellitus and arthritis are the most common health problem in the World, and the prevalence of this disease is rapidly increasing. Despite the availability of synthetic drugs, herbal formulation is desirable, and hence they are investigated with renewed interest all over the World. Therapy with the herbal drugs is an older traditional system and plants have been used over the years for the treatment of arthritis and diabetes mellitus. A lot of researchers and scientists to evaluate the biological activity, less toxicity and safety of medicinal plants to promote their usage for the development of new pharmaceuticals which may be more potent than currently used for the diabetes and arthritis.

Among the thousands of Indian medicinal plants *Aegle marmelos* (Corr.), *Moringa oleifera* Lam, *Paederia foetida* (Linn.) and *Melastoma malabathricum* (Linn.) were selected for the present study on the basis of their use in Ayurvedic & traditional medicine. The literature survey revealed that these plants were used in different polyherbal preparations and extract used to treat the hypoglycemia and arthritic disorder lack scientific experimental evidence of their antidiabetic and antiarthritic activity. In view of the above facts, it was thought worthwhile to take the phytopharmacological screening of these plants for their antidiabetic and antiarthritic activity using different in-vivo models.

The stem of *Aegle marmelos* (Corr.). was collected from the Herbal garden, Department of Pharmaceutical Sciences, SHIATS, Allahabad, India and the plant material was authenticated by the Dr. Imran kajmi, Siddhartha Institute of Pharmacy, Dehradun, Uttarakhand, India and standard herbarium specimens deposited in the same department for further use. The plant materials were subjected to the shade dried and crushed with the help of the grinder to make the powered.

A thin section of the *Aegle marmelos* (Corr.) stem showed small, thick-walled sclerenchyma on the inside of the epidermis. The epidermis layer consists of the single layer of living cells, thickened and covered with waterproof layer called as the cuticle. The layers of the epidermis are closely packed. The layer of the epidermis followed by large thin-walled parenchyma cells which having the intracellular sir spaces. Just below the epidermis there are 2-3 layer of collenchymatous cells with thickened cell walls present. Blow the collenchymas cells are a few layers of parenchyma present with intracellular space. The vascular bundles are situated in a ring on the inside of the plant. The t.s. of the stem contain the xylem, phloem and cambium. The xylem found in the center part of the vascular bundle and phloem found in the outside of the vascular bundle. The cambium separates the xylem and phloem. Xylem of vessels with simple end-walls, partially developed. The smaller vessels constituting the protoxylem and the bigger ones constituting the metaxylem lie away from the center (figure 3.2.2). The
protoxylem consists of annular, spiral and scalariform vessels, and the metaxylem of reticulate and pitted vessels. Cambium consists of 2-3 layers of thin walled and rectangular, and is arranged in radial rows. Fewer layers of fairly big polygonal or readily elongated parenchymatous cell packed with yellow-brown masses (pigments).

The collected plant material was subjected to the proximate analysis. The *Aegle marmelos* (Corr.) contains the 1.4-1.8% foreign matter and the ash value of the plant indicated the inorganic material as 12.5%. While acid insoluble ash was 1.75% and the water soluble ash value is 2.76% respectively. The moisture content present in the plant material is found to be 3.25% respectively. The water soluble extractive value of the plant found is to be 14.32% and ethanol soluble extractive value is 35.25% respectively.

The air dried coarsely powdered plant material (50g), was subjected to the successive extraction in the soxhlet apparatus using the petroleum ether, ethyl acetate, chloroform, methanol and water solvent. The extractive value of the plant material in the successive extraction was 0.14%, 0.22%, 0.43%, 6.15% and 3.21% respectively on the dry basis.

The successive extract was subjected to the chemical test for identification of the chemical present in the particular solvent. Preliminary phytochemical screening of the various extracts revealed the presence of the alkaloids, carbohydrates, glycosides, phenolic compound, tannin, saponin, sterol, gum and mucilage were present in the *Aegle marmelos* (Corr.).

The plant material of the *Aegle marmelos* (Corr.). (5 kg) dried, powdered and subjected to extraction in the soxhlet apparatus using the methanolic extract. The methanolic extract was subjected to the column chromatography; the methanolic extract was separated two compounds and these separated compounds was characterized as the umbelliferone β-D-galactopyranoside and Umbelliferone diglucoside by the help of the $^1$H and $^{13}$C NMR, Mass, FTIR. Umbelliferone β-D-galactopyranoside (UFG) and Umbelliferon-7-O-α-D-glucopyranosyl-(2→1)$^\text{II}$ -α-D-glucopyranoside (UFD) were evaluated for anti diabetic (oral glucose tolerance test and streptozotocin induced model), antiarthritic (turpentine oil induced model, formaldehyde induced model and complete Freund’s arthritis induced model) activity at different doses.

UFG orally treated rats exhibited normal behavior till doses 100 mg/kg, these groups behave normally on touching and pain response. There was no lethality or any toxic reactions found with the selected dose until the end of the study. The acute and chronic anti-inflammatory activity of the UFG was evaluated against the turpentine oil induced joint edema, formaldehyde Complete Freund’s Adjuvantin induced arthritic methods. Three different doses of the UFG administered orally, significantly inhibited the joint edema developed by the turpentine oil at dose dependent manner. The
significant inhibitory effect of UFG was observed in the formaldehyde induced proliferative global edematous arthritis when administered orally. CFA induced arthritis is a chronic cytokine mediated destructive inflammatory disease; that affected the articulations are infiltrated by blood derived cells. CFA induced arthritis, developed the redness and swelling over the twenty four hour period in the foot injected with adjuvant and these redness and swelling develops the inflammation for the next few weeks and increase arthritis. CFA induced inflammation developed the arthritis by the two reactions; the primary reaction developing the swelling in the hind paw and secondary reaction developed the swelling in the front paw and developing the nodules in the ear and tails. CFA induced arthritic rats treated with the different doses of the UFG significantly deceased the humoral immune response in the both types of the reactions. CFA induced arthritic rats showed the decline in the body weight throughout the study. The decline body weight in CFA induced arthritic rats due to deficient absorption of glucose and leucine through the intestine. UFG significantly decrease the body weight due to increase the absorption of the glucose and leucine through the intestine and reduced the distress caused by the bacterial induced arthritis. CFA induced arthritic rat start showing the evidence of clinical inflammation in one or more hind paw of the day 5. The maximum sign of arthritis index was observed after the day 13. The UFG treatment was initiated at the onset stage of polyarthritis development. CFA induced arthritic control group rat rapidly increased the arthritic sign from the day 10 which indicated that the polyarthritic symptoms had certainly developed. CFA induced arthritic rat treated with different doses of the UFG showed little or no difference till day 13. However, after this CFA induced arthritic development phase, the arthritic indexes started to decrease and finally reached less than 60% in all groups as compared to the CFA induced arthritic control group rats. During the arthritic condition, CFA activates the inflammatory mediators, ROS in large amount and start the generation of the free radical in the inflamed area to damaging of the tissue. ROS and free radical altered the activity of the endogenous antioxidant defenses, start the production of the superoxide, \( \text{H}_2\text{O}_2 \) and impairment the destruction of the affected joint such as synovial fluid, cartilage and other articular constituents. Increasing levels of the ROS and free radical decline the level of the antioxidant enzyme level leading to cell damage and increased the lipid peroxidation. CFA induced rats treated with the different doses of the UFG significantly increased the level of the antioxidant enzyme such as SOD, GSH, GPx and deceased the level of the MDA. Development of the anemia is the common problem in the arthritis because in the arthritic condition decrease the level of RBC, Hb and increase level of the WBC, ESR. The decrease level of RBC, Hb represents the abnormal storage of iron in the reticuloendothelial system in synovial tissue, failure of bone marrow and increases the level of the leukocyte count. CFA induced arthritic rats treated with the UFG significantly decaes the leukocyte count by stimulation of the immune system against the
invading antigens and showing the immune modulating effect. ESR is the number of the cells and concentration of proteins, especially fibrinogen, alpha and beta globins. ESR was an estimate of the suspension stability of RBC’s in plasma. The ESR counted significantly decreased by the treatment of the UFG justified the antiarthritic effect of the drug. The level of the WBC increased mild to moderate is the common feature of the inflammatory reaction. WBC level was increased in the arthritic condition due to microbial infection and releasing the IL-2B inflammatory cells. IL-2B increased the production of the granulocyte and macrophage colony stimulating factors. UFG significantly decreased the level of the WBC by decreasing the level of the inflammatory mediator and macrophages colony stimulator factors.

Three different doses of the UFG significantly (87±1.789) reduced the blood sugar level in oral glucose tolerance test mode when compared to the glibenclamide (88.6±1.568) showed the better utilization of the glucose. STZ induced diabetic rats treated with the different doses of the UFG significantly (123.4±2.379) reduced the blood sugar level when compared to the glibenclamide (136.4±1.99). Three different doses of the UFG significantly improve the plasma insulin level in the STZ induced diabetic rats. The improvement of the plasma insulin level well supported by the histopathology studies of STZ induced diabetic rat treated with the different doses of the UFG. Different doses of UFG treated rats showing a considerable regeneration in the β cells of pancreas and improve the plasma insulin production by the attributed of the positive influence on endocrine cells of the pancreas. Another biochemical parameter such as hexokinase, glucose-6-phosphate and fructose-1-6-biphosphatase significantly improved by the treatment of the different doses of the UFG and well supported by the antidiabetic effect of the UFG. The lipid abnormality is the prime factor of the developing the diabetes because in normal condition insulin activates the lipoprotein lipase enzyme and triglyceride hydrolysis. The lipid abnormality circulating the glucose intolerance by insensitivity of peripheral tissue of insulin and inactivates the both enzyme and causes the hypercholesterolemia and hypertriglyceridemia. Due to lipid abnormality in the diabetes, increase the level of the lipids i.e. total cholesterol, triglyceride, LDL cholesterol, VLDL cholesterol and decrease the level of the HDL cholesterol. Three different doses of the UFG significantly (P<0.001) decreasing the level of the total cholesterol, triglyceride, LDL cholesterol, VLDL cholesterol and increases the level of the HDL cholesterol as compared to the glibenclamide. The hyperlipidaemic effect of the UFG well supported by the histopathology studies of the heart and the kidney. Kidney and heart histopathology showed the accumulation of the fats in the diabetes condition, but the STZ induced diabetic rats treated with the different doses of the UFG significantly decline the accumulation of the fats on the kidney and heart histopathology. The major role of the UFG in the treatment of the diabetes on the basis of the antioxidant property. Free radical plays an important role in increasing the diabetes complications,
several methods are involved in the generation of the free radical in diabetes such as glucose autooxidation, lipid peroxidation, protein glycation, polyol pathway and the formation of advanced glycation. STZ induced diabetes, destroy the pancreatic insulin secreting β-cells and enhancing the level of reactive oxygen species. These generated ROS start to react with all biological substances and cell membrane in the body tissue and increases the level of the lipid peroxidation. LPO starts the impairing the membrane functions by inhibiting the membrane fluidity and altering the activity of membrane bound enzyme, receptors and decreasing the level of the antioxidant enzymes such as SOD, CAT, GPx and increasing the level of the MDA. Three different doses of the UFG significantly decrease the level of the antioxidant enzyme SOD, CAT, GPx and increasing the level of the MDA when compared to the glibenclamide. The result suggests that the UFG has the potent antioxidant activity to reduce the diabetes complication arising by the free radical generations.

Acute toxicity studies of the bioactive compound of UFD revealed the non-toxic nature in the lower dose. There was no lethality or any toxic reactions found with the selected doses up to 100 mg/kg until the end of the specific study. The acute and chronic anti-inflammatory activity of the UFD was evaluated against the turpentine oil induced joint edema, formaldehyde Complete Freund’s adjuvant in induced arthritic methods. Three different doses of the UFD administered orally, significantly inhibited the joint edema developed by the turpentine oil at dose dependent manner. The significant inhibitory effect of UFD was observed in the formaldehyde induced proliferative global edematous arthritis when administered orally. CFA induced arthritis has been shown the number of clinical, chronic and immunological features similar to the human arthritis. Swelling in the hind paw is the primary reaction; characterized feature of the CFA induced arthritis, which persisted for weeks and primary reaction followed by the development of the arthritic nodules in ear, tails and swelling in the contralateral, this is called delayed response (secondary reaction). CFA induced arthritic control group rats showed an increase the paw joint diameter till the day 28, which can be attributed to the delayed immunological flare in the disease. The result suggests that UFD significantly decrease the humoral immune response and secondary delayed reaction was occurring due to the delayed hypersensitivity reaction. CFA induced arthritic control group rats; continuous shows the decreasing level of the body weight of the rats due to the deficient absorption of nutrients through the intestine. CFA induced arthritic rats treated with the UFD significantly improving the body weight as compared to the CFA induced arthritic control group rats. The possible mechanism of action of the UFD on the improvement of the body weight may be decreasing the absorption of the nutrient through the intestine and normalize the process of absorption. CFA induced arthritic rat start showing the evidence of clinical inflammation in one or more hind paw of the day 5. The maximum sign of arthritis index was observed after the day 13. CFA induced arthritic
control group rat rapidly increased the arthritic sign from the day 10 which indicated that the polyarthritic symptoms had certainly developed. CFA induced arthritic rat treated with the UFD showed little effect till day 13. However, after this CFA induced arthritic development phase, the arthritic indexes started to decrease and finally reached less than 60% in all groups as compared to the CFA induced arthritic control group rats. Anemia is the common problem in the arthritis because in the arthritic condition decease the level of the RBC, Hb and increase level of the WBC, ESR. CFA induced arthritic condition, increased the level of the WBC to IL-1B and production of the inflammatory granulocyte and macrophage colony stimulating factor. Due to increase the level of the IL-1B, it rises in the production of the inflammatory granulocyte and macrophage colony stimulating factors. Due to increase in the level of the granulocyte and macrophage colony increased the level of the WBC and decrease the level of the RBC count. CFA induced arthritic rats decreased the level of Hb count and increased the level of the ESR due to reduced erythropoietin levels. CFA induced arthritis decreased Hb and response of the bone marrow erythropoietin and premature destruction of red blood cells. Similarly, increase level of ESR is an estimation of the suspension stability of RBC in plasma. ESR is attributed to the accelerated formation of endogenous protein such as especially fibrinogen, alpha and beta globulins. CFA induced arthritic rat treated with the UFD significantly improved the level of the RBC, Hb and Decline the level of the ESR, WBC further supports its anti-arthritic effect. Free radicals, ROS, oxidative stress and reactive oxygen play an important role in the tissue damage during CFA induced arthritic condition. Free radicals, ROS, oxidative stress start the degradation of the synovial fluid and induced depolymerization of hyaluronic acid, which is turned to lead to a loss of viscosity in the joints and endogenous antioxidant defense. The oxidative stress or reactive oxygen species produced the cartilage destruction in CFA induced arthritic rats, which turn to decrease when treated with the UFD. Because UFD increase the activity of the endogenous antioxidant such as SOD, GPx, GSH and decrease the level of the MDA. The possible mechanism of action of the UFD neutralization of various free radicals generated at the site of the inflammation by increasing the activity of the antioxidant enzymes.

Oral glucose tolerance test studies showed the UFD significantly (62.6±1.327) decline the level of the blood sugar when compared to the glibenclamide (69.6±1.248). STZ induced diabetes model the UFD significantly (107.4±2.731) declines the blood sugar level as compared to the glibenclamide (117.2±2.764). UFD treated group rat showed the improve level of the insulin as compared to the glibenclamide. The improvement of the insulin level well supported by the histopathology studies of the panaceas. The histopathology study showing the regeneration of the β cells and generating β cells improves the secretion of the insulin. STZ induced diabetic rat show the essence of the various hepatic enzymes viz. hexokinase, glucose-6-Phosphate and Fructose-1-6-biphosphatase. STZ induced diabetic
rat showing the accumulation of the fat and carbohydrate in the liver. The accumulated fats and carbohydrate decreased the activity of the hepatic enzymes. But the treatment of the STZ induced diabetic rat with UFD significantly increases the level of the hexokinase and decline the level of the glucose-6-Phosphate, Fructose-1-6-biphosphatase. The result was well supported by the kidney histopathology studies. Hyperlipidemia and hypercholesterolemia are the major risk factors in the diabetes mellitus. Diabetes directly affected to the pancreatic β-cells, which inhibit the insulin secretion and production, due to derangements of the metabolic and regulatory process of insulin, lipids (total cholesterol and triglyceride) start to accumulate. UFD containing the potent antioxidant activity to reduce the free radical generation because the free radical plays an important role in the formation of the diabetes. These free radicals react with all biological substances and cell membrane in the body tissue and increase the level of the LPO. LPO alters the activity of membrane bound enzyme, receptors and altering the level of endogenous antioxidant enzymes such as SOD, CAT, GPx and MDA. But the STZ induced diabetic rat treated with the UFD significantly increased the level of the SOD, CAT, GPx and increasing the level of the MDA when compared to the glibenclamide. UFD has the potent antioxidant activity and decline the diabetes complication arise from the generation of free radicals.

The stem of *Moringa oleifera* Lam was collected from the Herbal garden, Department of Pharmaceutical Sciences, SHIATS, Allahabad, India and the plant material was authenticated by the Mr. Imran Kazmi, Siddhartha Institute of Pharmacy, Dehradun, Uttarakhand, India and standard herbarium specimens deposited in the department for further use.

A thin section of the *Moringa oleifera* (Lam.) stem showed the small thicked walled sclerenchyma on the inside of the epidermis section. Epidermis layer is closely packed and consists of the single layer of the thickened and covered waterproof layer of the cuticle. The layer of the collenchyma found below the epidermis layer. Below the collenchyma layer there is 4-5 layer of the parenchyma found in intracellular space. The vascular bundle found on the inside of the ring. The ts of the plant contain the xylem, phloem and cambium. The xylem found in the center part and phloem found in the outside in the vascular bundle. The cambium found in the separation part of the xylem and phloem. Xylem of vessels with simple end-walls, partially developed. The smaller vessels constituting the protoxylem and the bigger ones constituting the metaxylem lie away from the center. The protoxylem consists of annular, spiral and scalariform vessels, and the metaxylem of reticulate and pitted vessels. Cambium consists of 2-3 layers of thin walled and rectangular, and is arranged in radial rows. Fewer layers of fairly big polygonal or readily elongated parenchymatous cell packed with yellow-brown masses (pigments).
The collected plant materials were subjected to the shade dried and crushed with the help of the grinder to make the powered and subjected to the proximate analysis. The *Moringa oleifera* (Lam.) contains the 1.2-1.6% foreign matter, 10.9% ash value, 1.52% acid insoluble ash and 2.01% water soluble ash, respectively. The moisture content present in the plant material is found to be 2.75% respectively. The water soluble extractive value of the plant found is to be 8.24% and ethanol soluble extractive value is 26.52% respectively.

The air dried coarsely powdered plant material (50g), was subjected to the successive extraction in the soxhlet apparatus using the petroleum ether, ethyl acetate, chloroform, methanol and water solvent. The extractive value of the plant material in the successive extraction was 0.08%, 0.15%, 0.21%, 4.10% and 1.12% respectively on the dry basis.

The successive extract was subjected to the chemical test for identification of the chemical present in the particular solvent. Preliminary phytochemical screening of the various extracts revealed the presence of the alkaloids, glycosides, phenolic compound, tannin, saponin, sterol, gum and mucilage were present in the *Moringa oleifera* (Lam.)

The plant material of the *Moringa oleifera* (Lam.) (2 kg) dried, powdered and subjected to extraction in the soxhlet apparatus using the methanolic extract. The methanolic extract was subjected to the HPTLC to identify the bioactive compound quercetin.

The acute and chronic anti-inflammatory activity of the *MO* was evaluated against the turpentine oil induced joint edema, formaldehyde Complete Freund ‘s adjuvant in induced arthritic methods. Three different doses of the *MO* administered orally, significantly inhibited the joint edema developed by the turpentine oil at dose dependent manner. The significant inhibitory effect of *MO* was observed in the formaldehyde induced proliferative global edematous arthritis when administered orally. CFA induced arthritis; it was observed that swelling and redness developed in rats after injecting the CFA over 24 hours. It seems that bacterial peptidoglycon and muramyl dipeptide are responsible for its induction and chronic inflammation reaction slowly developed next 8 – 10 days. Chronic inflammation occurs in multiple joints with the influence of inflammatory cells, erosion of joint cartilage and bone destruction. Cytokines, GM-CSF (Granulocyte-macrophage colony-stimulating factor), interferon like mediator is responsible for the chronic inflammation and pain, destruction of bone and cartilage. CFA induced arthritic rat treated with the *MO* significantly inhibit the paw swelling and redness in the infected area showed the antiarthritic effect. The body weight loss was observed continuously in the CFA induced arthritic control group rats due to the deficient absorption of nutrients through the intestine. CFA induced arthritic rats treated with the *MO* significantly improving the body weight as compared to the CFA induced arthritic control group rats. The possible mechanism of action of the *MO* extract on the
improvement of body weight may be decreasing the absorption of the nutrient through the intestine and normalize the process of absorption. CFA induced arthritic rat start showing the clinical inflammation in one or more hind paw of the day 5. The maximum sign of arthritis index was observed after the day 13 in the CFA induced arthritic control group rats. CFA induced arthritic control group rat rapidly increased the arthritic sign from the day 10 which indicated that the polyarthritic symptoms had certainly developed. CFA induced arthritic rat treated with the MO showed little effect on the arthritic sign till day 13. However, after this CFA induced arthritic development phase, the arthritic indexes started to decrease and finally reached less than 60% in all groups as compared to the CFA induced arthritic control group rats. During the arthritic condition changes in the hematological parameters is the common problem. Arthritic condition increases the level of the WBC, ESR and decrease the level of the RBC, Hb. WBC and ESR increased in CFA induced arthritic condition due to IL-1B mediated rise in the respective colony stimulating factors and start the migration of leukocytes to the inflamed area. Decreasing the level of the RBC, Hb causes the anemic condition of the arthritic condition. Decreasing the level of the RBC, Hb in arthritic condition due to loss of the blood from the gastrointestinal due to medication and bone marrow changes in patients with inflammatory arthritis, which prevent the release of iron for incorporation into red blood cells and decreasing the level of the RBC and Hb. Our result suggests that MO showed significant recovery from the induced anemia with an increase in the level of RBC, Hb and decreases the level of WBC, ESR. Free radicals, ROS, oxidative stress start the degradation of the synovial fluid and induced depolymerization of hyaluronic acid, which is turned to lead to a loss of viscosity in the joints and decrease the level of the endogenous antioxidant. CFA induced arthritic rat treated with the MO showed the significant improvement of the endogenous antioxidant till completion of the study.

Oral glucose tolerance test was performed for the identification of the glucose tolerance. Three different doses of the MO showed the significantly (92±1.304) decline the blood glucose level when compared to the glibenclamide (83±1.924). STZ induced diabetic rat treated with the MO significantly (98.6±1.435) inhibit the blood glucose level as compared to the glibenclamide (83±1.924) and the increasing the level of pancreatic insulin confirm the antidiabetic effect of the MO extract. This correlation was confirmed by the histopathology studies of the panaceas, the extract of the MO showed the regeneration of the β cells and these β cells improve the secretion of the insulin. Another diabetic parameter such as hexokinase, glucose-6-Phosphate and Fructose-1-6-biphosphatase showed the mark changes in the STZ induced diabetes. The MO extract brought back these diabetic parameters near to the normal level and confirmed the antidiabetic effect. Another complication in the diabetes is the lipid abnormality, which was affected by the inhibition of the insulin and start the lipid accumulate on the
different tissue. The MO extract treated group showed the mark changes in the lipid abnormalities. The MO extract showed the potent antioxidant activity to alter the level of the antioxidant enzymes. The antioxidant enzymes such as SOD, CAT, GPx increase and MDA level decease in the STZ induced diabetic rats. The MO extracts significantly SOD, CAT, GPx and increasing the level of the MDA when compared to the glibenclamide. The antioxidant properties of the MO extract also beneficial to cure the diabetes complications because the free radical plays an important role in the spreading the diabetes complications.

The leaves of Paederia foetida (Linn.) were collected from the Herbal garden, Department of Life Sciences, Dibrugarh University, Dibrugarh, Assam, India and the plant material was authenticated by the Botanical Survey of India, Shillong, India and standard herbarium specimens deposited in the Botanical Survey of India for further use.

A thin section of the leaves of the Paederia foetida (Linn.) is particularly dorsi-ventral with prominent midrib and lamina. The microscopy of the leaves of the paederia foetida (Linn.) showed the 3-4 layer of the lower and the upper epidermis covered by the uniseriate straight trichomes. The mesophyll composed of single layered palisade cells and 3-4 layered spongy tissue. The epidermis composed of the 2-5 layer of the collenchyma towards the upper and lower side and the rest of the part covered by the parenchyma. The leaves contain the 3-4 layer of the collenchyma. The lamina part of the leaves showed the dorsiventral structure, epidermis single layered covered externally with striated cuticles. The center part of the leave microscopy contains the crescent shaped vascular bundle consisting usual elements with xylem (lignified cells, present at ventral surface) towards upper side and the lower side phloem (non lignified cells present at dorsal surface) are present. Other cell content such as starch grain, oil globules, calcium oxalate are found near the vascular bundle.

The collected plant materials were subjected to the shade dried and crushed with the help of the grinder to make the powered and subjected to the proximate analysis. The Paederia foetida (Linn.) contains the 1.4-1.6% foreign matter, 10% ash value, 1.5% acid insoluble ash and 2.1% water soluble ash, respectively. The moisture content present in the plant material is found to be 3.5% respectively. The water soluble extractive value of the plant found is to be 16.80% and ethanol soluble extractive value is 31.71% respectively.

The leaf of the Paederia foetida (Linn.). was subjected to pharmacognostical studies. The transverse section of leaf the showed upper epidermis, lower epidermis, midrib, phloem, palisade, mesophyll, vascular bundle and xylem present in the Paederia foetida (Linn.).

The air dried coarsely powdered plant material (50g), was subjected to the successive extraction in the soxhlet apparatus using the petroleum ether, ethyl acetate, chloroform, methanol and water
solvent. The extractive value of the plant material in the successive extraction was 0.37%, 0.21%, 0.78%, 11.2% and 6.06% respectively on the dry basis.

The successive extract was subjected to the chemical test for identification of the chemical present in the particular solvent. Preliminary phytochemical screening of the various extracts revealed the presence of the glycosides, phenolic compound, tannin, sterol, gum and mucilage were present in the Paederia foetida (Linn.).

The plant material of the Paederia foetida (Linn.) (2 kg) dried, powdered and subjected to extraction in the soxhlet apparatus using the methanolic extract. The methanolic extract was subjected to the HPTLC to identify the bioactive compound ascorbic acid.

The acute and chronic anti-inflammatory activity of the PF was evaluated against the turpentine oil induced joint edema, formaldehyde Complete Freund’s Adjuvant in induced arthritic methods. Three different doses of the PF administered orally, significantly inhibited the joint edema developed by the turpentine oil at dose dependent manner. The significant inhibitory effect of PF was observed in the formaldehyde induced proliferative global edematous arthritis when administered orally. CFA induced arthritis is the very widely used method in which the clinical and pathological changes are comparatively similar to the human arthritis in the pathologic and sociological changes. CFA induced arthritic; the rat develops the paw swelling in the multiple joints due to the accumulation of the inflammatory cells, joint cartilage erosion and bone destruction. CFA induced arthritis we observed the inflammation was developed in the injected ankle on day 3, after injecting the CFA injection. CFA induced chronic inflammation progressively increased the paw volume (which persist for weeks that is the primary reactions), redness in the rat hind paw and forelimbs on the day 10. This primary reaction increases the swelling in the contralateral and front paws along with appearances of arthritic nodules in ear and tail (secondary inflammation). The primary reaction development is due to deposition of the irritant effect of the adjuvant in the soft tissue, whereas the primary reaction developed the secondary reaction by redness and thickness of the foot paw presumed to be immunologic events. CFA induced arthritic rat treated with the different doses of the PF was showing the inhibitory effect on the increased paw volume and redness in the rat hind paw and forelimbs. The decline in the body weight was observed in the CFA induced arthritic rats due to deficient absorption of nutrients through the intestine. CFA induced arthritic rat treated with the PF showed the improvement in the body weight by enhanced the intestinal absorption of the nutrients and decline in the distress caused by the severity of the arthritis. CFA induced arthritic rat start showing the clinical inflammation in one or more hind paw of the day 5. The maximum sign of arthritis index was observed after the day 13 in the CFA induced arthritic control group rats. CFA induced arthritic control group rat rapidly increased the arthritic sign from the day 10
which indicated that the polyarthritic symptoms had certainly developed. CFA induced arthritic rat treated with the *PF* showed little effect on the arthritic sign till day 13. However, after this CFA induced arthritic development phase, the arthritic indexes started to decrease and finally reached less than 50% in all groups as compared to the CFA induced arthritic control group rats. During the arthritic condition changes in the hematological parameters is the common problem. CFA induced arthritic rat decreased the level of the RBC, Hb and increased the level of the WBC, ESR. Decreased level of the RBC is the very common in the arthritic patient, decreased level of the RBC turned into the anemia. Decreasing the level of the RBC and Hb due to loss of the blood from the gastrointestinal during arthritic treatment and other reason due to change in the bone marrow, which prevent the iron incorporation with the RBC and decreasing the level of the RBC and Hb. Increased the level of the ESR due to the fibrinogen and globulin and WBC level due to the inhibition of the leukocytes to the inflamed in arthritis condition. CFA induced arthritic rat treated with the *PF* significantly improved the level of the RBC and Hb and decline the level of the ESR and WBC. It is well known that free radicals/reactive oxygen species play an important role in inflammation. CFA induced arthritic conditions, increased the production of the free radical mainly superoxide, hydroxyl radical, hypochlorous acid and hydrogen peroxide radical due to macrophages and granulocytes. Lipid peroxidation is a critical mechanism occurred due increasing the free radical production and injured the tissue during the rheumatism arthritis condition. The increase level, lipid peroxidation was evaluated by the malondialdehyde activity (MDA); MDA is a pro-oxidant factor, which determines the oxidative stress present in the rats. Glutathione and superoxide dismutase is the first line antioxidant against the free radicals they catalytically scavenge the hydrogen peroxide, superoxide and other antioxidant enzyme glutathione peroxide reduced the H2O2 in the presence of the glutathione to form oxidized glutathione and water. CFA induced arthritic rat treated with the *PF* significantly improved the level of the antioxidant enzyme SOD, GSH, GPx and decline the level of the MDA as compared to the arthritic control groups.

Oral glucose tolerance test was performed for the identification of the glucose tolerance of the rats. The *PF* showed the significantly (64±0.324) decline the blood glucose level when compared to the glibenclamide (68.4±1.208). STZ induced diabetic rat treated with the *MO* significantly (107.6±1.749) inhibit the blood glucose level as compared to the glibenclamide (122±1.844). STZ induced diabetic rat treated with *PF* is increasing the level of pancreatic insulin confirm the antidiabetic effect of the *PF* extract. The possible effect of *PF* by stimulating the insulin secretion and regeneration of the β-cells of the pancreas or increasing cellularity of the islet tissue and regeneration of the granules in the β-cells. Based upon the result, it can be hypothesized that *PF* decline the blood glucose and improved the pancreas insulin level. This hypothesis further confirmed by the histopathology studies of the pancreas,
Pharmacognostical and pharmacological evaluation of some medicinal plants

which showed protection of the pancreas from the toxic effect of microbial streptozotocin. Another diabetic parameter such as hexokinase, glucose-6-Phosphate and Fructose-1-6-biphosphatase showed the mark changes in the STZ induced diabetes. STZ induced diabetic rat treated with PF extract brought back these diabetic parameter near to the normal level and confirmed the antidiabetic effect. Hypertriglyceridemia and hypercholesterolemia are the common factors which are involved in the diabetes. This occurs due to lack of the insulin, which activates the lipase enzyme, hydrolyzed the triglyceride, releasing the fatty acid and glycerol into the circulating blood. STZ induced diabetes often involves abnormal lipid metabolism, which is a metabolic disorder in diabetes complications. Increasing levels of the cholesterol are the major factors for coronary heart disease. LDL and VLDL start the deposition in the peripheral tissue in the diabetic condition. STZ induced diabetic condition rat increased the level of LDL and VLDL and the treatment start with PF decreasing the higher level of LDL and VLDL cholesterol. STZ induced diabetic rat treated with the PF extract for 28 days to produce improved the level of TC, TG, LDL, VLDL and decline of HDL cholesterol. According to the some of the scientist that the oxidative stress plays an important role in the microvascular and macrovascular complication of diabetes. Damaging the organ is the most common problem due to the defective cell antioxidant response against the oxidative stress generated in the diabetic condition. STZ induced diabetic rat increased the level of the antioxidant marker, several mechanisms of action are involved like overproduction of the free radical, glucose autooxidation, protein glycation, formation of advanced glycation products and polyol pathway. STZ induced diabetic condition increased the level of the hepatic and renal MDA level and decreasing the SOD, CAT, GPx level indicating the increased free radical generation. STZ induced diabetic rat treated with PF extract decreased the level of MDA and improved the level of SOD, CAT and GPx and posses the antioxidant effect on the diabetes condition.

The leaves of *Melastoma malabathricum* (Linn.) were collected from the Herbal garden, Department of Life Sciences, Dibrugarh University, Dibrugarh, Assam, India and the plant material was authenticated by the Botanical Survey of India, Shillong, India and standard herbarium specimens deposited in the Botanical Survey of India for further use.

The thin section of the leaf of the melastoma malabathricum (Linn.) is particularly dorsi-ventral with prominent region of the midrib and the lamina. The leaf microscopy showed the 5-6 layer of the upper epidermis and the lower epidermis covered with the trichmoes. The epidermis part of the leaf composed of the 2-5 layer of the collenchyma and the rest of the part covered by the parenchyma. The mesophyll section of the leaves composed of the 5-8 layer of the spongy tissue. The lamina section of the leaf shows the dorsiventral structure. The central part of the leaf contains the crescent shaped vascular bundle consisting usual elements with xylem (lignified cells, present at ventral surface) towards
upper side and the phloem (non lignified cells present at dorsal surface) lower side. Other cell content such as starch grain, oil globules, calcium oxalate are found near the vascular bundle.

The collected plant materials were subjected to the shade dried and crushed with the help of the grinder to make the powered and subjected to the proximate analysis. The *Melastoma malabathricum* (Linn.) contains the 2.0-2.2% foreign matter, 7.5% ash value, 0.75% acid insoluble ash and 1.1% water soluble ash, respectively. The moisture content present in the plant material is found to be 2.5% respectively. The water soluble extractive value of the plant found is to be 9.50% and ethanol soluble extractive value is 40.55% respectively.

The air dried coarsely powdered plant material (50g), was subjected to the successive extraction in the soxhlet apparatus using the petroleum ether, ethyl acetate, chloroform, methanol and water solvent. The extractive value of the plant material in the successive extraction was 0.18%, 0.22%, 0.26%, 6.22% and 3.33% respectively on the dry basis.

The successive extract was subjected to the chemical test for identification of the chemical present in the particular solvent. Preliminary phytochemical screening of the various extracts revealed the presence of the phenolic compound, tannin, saponin, sterol, gum and mucilage were present in the *Melastoma malabathricum* (Linn.).

The plant material of the *Melastoma malabathricum* (Linn.) (2 kg) dried, powdered and subjected to extraction in the soxhlet apparatus using the methanolic extract. The methanolic extract was subjected to the HPTLC to identify the bioactive compound quercetin.

Acute toxicity of the methanolic extract of *Melastoma malabathricum* revealed the non-toxic nature of the different doses. There were no lethality or toxic reactions found in the selected group which received the different doses of the extract until the end of the experimental period. The acute and chronic anti-inflammatory activity of the MM was evaluated against the turpentine oil induced joint edema, formaldehyde Complete Freund’s Adjuvant in induced arthritic methods. Three different doses of the MM administered orally, significantly inhibited the joint edema developed by the turpentine oil at dose dependent manner. The significantly inhibitory effect of MM was observed in the formaldehyde induced proliferative global edematous arthritis when administered orally. CFA induced arthritis is one of the most widely used models to study the clinical and pathogenesis changes are comparable with those seen in human arthritis other reason for used this method due to the correlation between efficacy of therapeutic agents and rheumatoid arthritis. CFA induced arthritis inflammation process firstly fenestration of microvasculature, leakage of the element into the interstitial space and the passage of macrophages and lymphocytes in the inflamed tissue, which adjuvant inoculation release number of inflammatory mediators. These mediators are responsible for pain, destruction of bone and cartilage that
can lead to several disabilities. CFA induced arthritis in rats affected the soft tissue and producing the swelling around the ankle joints during the development of arthritis, which was measured as edema of the particular tissues. CFA induced arthritic rat treated with the MM showed the inhibition of chronic swelling, inflammatory autocoid and proinflammatory, which could have led to an alteration in the immunological situation during the delayed phase of the response. The decline in the body weight was observed in the CFA induced arthritic rats due to deficient absorption of nutrients through the intestine. CFA induced arthritic rat treated with the MM showed the improvement in the body weight by enhanced the intestinal absorption of the nutrients and decline in the distress caused by the severity of the arthritis. CFA induced arthritic rat start showing the clinical inflammation in one or more hind paw of the day 5. The maximum sign of arthritis index was observed after the day 13 in the CFA induced arthritic control group rats. CFA induced arthritic control group rat rapidly increased the arthritic sign from the day 10 which indicated that the polyarthritic symptoms had certainly developed. CFA induced arthritic rat treated with the MM showed little effect on the arthritic sign till day 13. However, after this CFA induced arthritic development phase, the arthritic indexes started to decrease and finally reached less than 60% in all groups as compared to the CFA induced arthritic control group rats. Anemia is the common problem in the arthritic condition because the level of the WBC, ESR increases and the level of the RBC, Hb decreases. During the arthritic condition loss of the blood from the gastrointestinal and changes in the bone marrow, which prevent the incorporation of the iron with the RBC and decreasing the level of the RBC and Hb. During the arthritic condition increase the level of the WBC and ESR due to inhibition of the leukocytes and deposition of the fibrinogen and globulin in the inflamed condition. CFA induced arthritic rat treated with the MM significantly improved the level of the RBC and Hb and decline the level of the ESR and WBC and reduced the anemietic arthritic condition. It is well known fact about the inflammation that the free radical play an important role in the spreading the inflammatory condition. Free radical mainly superoxide, hydroxyl radical, hypochlorous acid and hydrogen peroxide radical increased the level of the macrophages and granulocytes during the arthritic condition. Lipid peroxidation is a critical mechanism occurred due increasing the free radical production and injured the tissue during the rheumatism arthritis condition. The increase level lipid peroxidation was evaluated by the malondialdehyde activity (MDA); MDA is a pro-oxidant factor, which determines the oxidative stress present in the rats. Glutathione and superoxide dismutase is the first line antioxidant against the free radicals they catalytically scavenge the hydrogen peroxide, superoxide and other antioxidant enzyme glutathione peroxide reduced the H₂O₂ in the presence of the glutathione to form oxidized glutathione and water. CFA induced arthritic rat treated with the MM significantly improved the level of...
the antioxidant enzyme SOD, GSH, GPx and decline the level of the MDA as compared to the arthritic control groups.

Oral glucose tolerance test was performed for the identification of the glucose tolerance of the rats. The $PF$ showed the significantly ($67.2\pm0.861$) decline the blood glucose level when compared to the glibenclamide ($72.7\pm0.872$). STZ induced diabetic rat treated with the $MM$ significantly ($86.2\pm1.428$) inhibit the blood glucose level as compared to the glibenclamide ($90.6\pm0.509$). STZ induced diabetic rat treated with $PF$ is increasing the level of pancreatic insulin confirm the antidiabetic effect of the $MM$ extract. The possible effect of $MM$ by stimulating the insulin secretion and regeneration of the β-cells of the pancreas or increasing cellularity of the islet tissue and regeneration of the granules in the β-cells. Based upon the result, it can be hypothesized that $MM$ decline the blood glucose and improved the pancreas insulin level. This hypothesis further confirmed by the histopathology studies of the pancreas, which showed protection of the pancreas from the toxic effect of microbial streptozotocin. The liver is the vital organ and plays an important role in defense the postprandial hyperglycemia and synthesis of glucose metabolism. The main role of the liver in glucose utilization is to convert the glucose into glucose-6-phosphatase by the help of hexokinase and the other role is it converts glucose into energy. STZ induced diabetic groups increased the level of glucose-6-phosphates, which increase the production of fats to carbohydrates, which turn to deposition into liver, kidney and altered the level of hexokinase, which decreased the conversion and utilization of glucose. STZ induced diabetic rat treated with $MM$ extract brought back these diabetic parameter near to the normal level and confirmed the antidiabetic effect. Higher levels of cholesterol (Hypercholesteremia) and higher level of triglyceride (hypertriglyceridemia) are the primary factor involved in the escalation of coronary heart disease and atherosclerosis, the secondary complications occurring in the diabetes. STZ induced diabetic groups treated with glibenclamide and different doses of $MM$ leaves extract brought back the increased level of total cholesterol and triglyceride near to the normal levels, which could be due to that all drugs treated group start the increased level of insulin secretion, which in turn, inhibit hormones sensitive lips and increase the utilization of glucose and decrease the mobilization of free fatty acids from the fat depositions. STZ induced diabetic groups increased the level of LDL cholesterol increased the coronary risk factor and decreased level of HDL cholesterol shown cardiovascular risk factor. In diabetic condition increased the level of TC and TG is associated with increased levels of LDL, VLDL and decreased level of HDL. In diabetic condition start the deposition of cholesterol (LDL and VLDL) in peripheral tissue, increased level of LDL and VLDL is atherogenic. Now treatment of the STZ induced diabetes groups start with the different doses of $MM$ leaves extract significantly reduced the serum total cholesterol, triglyceride LDL, VLDL and decreased the level of
MDA. The results suggest that different doses of *M*M extract were significantly lower the blood lipid abnormalities. According to the some of the scientist that the oxidative stress plays an important role in the microvascular and macrovascular complication of diabetes. Damaging the organ is the most common problem due to the defective cell antioxidant response against the oxidative stress generated in the diabetic condition. STZ induced diabetic rat increased the level of the antioxidant marker, several mechanisms of action are involved like overproduction of the free radical, glucose auto-oxidation, protein glycation, formation of advanced glycation products and polyol pathway. STZ induced diabetic condition increased the level of the hepatic and renal MDA level and decreasing the SOD, CAT, GPx level indicating the increased free radical generation. STZ induced diabetic rat treated with *M*M extract decreased the level of MDA and improved the level of SOD, CAT and GPx and posses the antioxidant effect on the diabetes condition.
To publish is to make content available to the general public.
List of research publications


Pharmacognostical and pharmacological evaluation of some medicinal plants
**List of conferences**


- **Kumar V**, Mujeeb M. Evaluation of antioxidant properties of hydrophilic and lipophilic extract of *Paederia foetida* L. SFRR-Europe 2011 Meeting on "Redox Biology and Micronutrients: From signaling to translation and back, Istanbul, 7-10 September 2011."
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