SUMMARY AND CONCLUSION

Plants are used by people since very early time for food, clothes and as a source of medicine. Plant derived products have been popular all over the world for the centuries. Tribal and other people of different countries used different types of plants for the treatment of diabetes. The ethnobotanical information reports about 800 plants that may possess antidiabetic potential and more than 1200 species of plants have been screened for activity on random basis. Herbal antidiabetic drug mainly belongs to plant, marine algae and fungi to phytogenetically advanced classes of compounds. Medicinal plants are most effective in diabetes and its complications. In addition to maintaining normal blood sugar level, some herbs are also reported to possess antioxidant activity, cholesterol-lowering action, restore the liver glycogen level and β-cells regeneration stimulating power. Most of the plants contain glycosides, alkaloids, terpenoids, flavonoids, carotenoids, saponins, etc., which are frequently implicated for having antidiabetic effect. Natural polymers like cellulose, gur gum, gum acacia and gum Arabic have the ability to reduce the calorific value of consumed diet by reducing absorption of carbohydrates from the gastrointestinal tract. In addition to herbs, minerals find wide applications in Ayurvedic prescription for diabetes.

Gymnema hirsutum Wight & Arn and Aristolochia bracteolata Lam small shrubs collected from uncultivated lands and hill areas and have no pesticides and are not eaten by the animals were selected for the present study. The leaves were shade dried and powdered. The phytochemical principles were screened qualitatively in various solvents of leaf extract. Levels of enzymic and non-enzymic antioxidants and free radical scavenging activity of 50 % hydroethanolic leaf extracts were also determined. The animal ethical committee permission for the present study was obtained.

Streptozotocin is used as an agent to induce diabetes mellitus by selective cytotoxicity effect on pancreatic β-cells. Thus, it affected endogenous insulin release and
as a result increased blood glucose level. The continuous administration of 50% hydroethanolic leaf extract of *G. hirsutum* Wight & Arn and *A. bracteolata* Lam at three different doses of 150 mg, 300 mg and 450 mg/kg bw/day for 30 days significantly reduced the blood glucose in STZ-induced diabetic rats and had no significant reduction of glucose in normal rats.

The leaf extracts (300 mg and 450 mg/kg bw/day) showed a comparable activity with the Glibenclamide treated groups. Glibenclamide is a standard antidiabetic drug that stimulates insulin secretion from β-cells. The effective hypoglycemic dose of 50% hydroethanolic leaf extract of *G. hirsutum* Wight & Arn and *A. bracteolata* Lam were found to be 300 mg/kg bw/day. The antidiabetic effects were compared with the effects of selected standard antidiabetic drug, Glibenclamide.

Levels of blood glucose, liver glycogen, plasma insulin, carbohydrate metabolizing enzymes, lipids, total protein, HbA₁c, stress markers of specific organs and histopathological analyses were carried out to determine the antidiabetic effect of *G. hirsutum* Wight & Arn and *A. bracteolata* Lam leaves. The phytochemicals in *G. hirsutum* Wight & Arn and *A. bracteolata* Lam were screened by HPTLC and GC-MS.

**The findings of the present study are**

- 50% hydroethanolic leaf extract of *G. hirsutum* Wight & Arn and *A. bracteolata* Lam were found to contain reasonable amount of alkaloids, flavanoids, saponins, phenolics, tannins and glycosides.

- Levels of enzymic antioxidants namely catalase, superoxide dismutase, glutathione peroxidase and non-enzymic antioxidants like vitamin C, vitamin E and reduced glutathione were found in rich amounts in both the 50% hydroethanolic extract of *G. hirsutum* Wight & Arn and *A. bracteolata* Lam leaves.

- Both the leaf extracts of *G. hirsutum* Wight & Arn and *A. bracteolata* Lam were found to be effective in inhibition of *in vitro* lipid peroxidation and superoxide generation and DPPH radical, hydroxyl radial and nitric oxide radical scavenging activities.
Materials and Methods

50% hydroethanolic leaf extract of *G. hirsutum* Wight & Arn concentration at 3 mg/ml posses effective antimicrobial activity on *B. aureus, K. pneumoniae, P. aurginoga and E. coli*.

The results of biochemical parameters assessed *viz.*, blood glucose, HbA$_{1c}$, total protein, serum insulin, creatinine, urea and liver glycogen in treated animal groups were close to that of normal control group.

The results of diabetic stress markers of serum AST, ALT, ALP, ACP, LDH and liver and kidney oxidative stress markers like AST, ALT, ALP, ACP and lipid peroxidation levels were significantly reduced in leaf extract treated and Glibenclamide treated diabetic groups when compared with diabetic control group.

Levels of catalase, SOD, GPx, GSH, Vitamin C, Vitamin A and Vitamin E in liver and kidney of experimental animal groups revealed that 50% hydroethanolic leaf extract of *G. hirsutum* Wight & Arn and *A. bracteolata* Lam have potent antioxidant effect in oxidatively stressed condition compared with Glibenclamide treated groups.

Cellular population and architecture of liver, pancreas and kidney in *G. hirsutum* Wight & Arn and *A. bracteolata* Lam treated diabetic rats significantly improved.

The results of HPTLC analysis of *G. hirsutum* Wight & Arn and *A. bracteolata* Lam leaf extracts indicated the presence of alkaloids, glycosides, phenolics and tannins in significant concentrations which are involved in management of diabetic conditions.

GC-MS analysis of 50 % ethanolic leaf extract of *G. hirsutum* Wight & Arn revealed the presence of 12 major compounds like fatty acids, phytol, fluoroquinoline, Gusation A and methyl esters.

GC-MS analysis of 50 % ethanolic leaf extract of *A. bracteolata* Lam revealed the presence of 9 major compounds including saturated and unsaturated fatty acids, phytol, benzamide and methyl phenanthrenol.
The findings of the present study clearly demonstrated that the 50% hydroethanolic leaf extract of *G. hirsutum* Wight & Arn and *A. bracteolata* Lam have a remarkable blood glucose lowering potential in streptozotocin-induced diabetic rats comparable to those produced by Glibenclamide. Therefore, leaves of *G. hirsutum* Wight & Arn and *A. bracteolata* Lam can be used as an effective hypoglycemic dietary adjunct for the treatment of diabetes and a potential source for the discovery of new bioreactive principle for future diabetic management. Thus it could be concluded that the 50% hydroethanolic leaf extract of *G. hirsutum* Wight & Arn and *A. bracteolata* Lam are hypoglycemic, hypolipidimic, antioxidant and organ protective. However, further experiments were required to isolate bioactive principles responsible for these pharmacological activities.