SUMMARY AND CONCLUSION

The thesis represents the results of the Pharmacognostical, pharmacological and anti oxidant studies on the three selected *Vigna* genus plants, is a study of Pharmacognostical characterization, Pharmacological screening of its hepatoprotective, antihyperlipedemic action, in correlation with *In vitro* antioxidant studies of *Vigna mung* Linn (Leguminosae ), *Vigna radiate* Linn (Leguminosae), *Vigna unguiculata* Linn (Leguminosae) , which are having traditional usage for curing liver disorders, Gastro intestinal infections, for reducing cholesterol, for curing inflammatory diseases etc.

The thesis consists of nine chapters presented in logical sequence

**Chapter- I**

In this chapter, the author described the general introduction to the plants and natural product discovery how the man started discovering different kinds of medicines from natural sources to treat various ailments, for the upliftment of human well being.

**Chapter-II**

In this chapter author described about the aim and objective of work towards the carrying of research on the *Vigna* genus plants .The research envisaged on the selected plants was explained, followed by the stepwise plan of work in order to achieve the objective.
Chapter-III

This chapter describes about the introduction to Leguminosae family plants, various types of *Vigna* genus plants, Taxonomical characterization and description of selected plants folklore usage of various *Vigna* genus plants which acts as a base for this thesis study. Literature review of the selected plants *Vigna mung* Linn, *Vigna radiate* Linn, *Vigna ungiculata* Linn were given in this chapter.

Chapter -IV

In this chapter, the detailed pharmacognostic parameters were studied to identify and determine the identifying characters. Microscopical characters were observed through transverse section and powder microscopic characterization. The results revealed that identifying characters like Glandular trichomes, Covering trichomes, Anisocytic stomata, phloem fibers, pitted vascular bundles. Quantitative microscopy like leaf constants like stomatal index, stomatal number, palisade ratio, veinislet number, vein termination number were determined, which can be another identifying tool for *Vigna mung* Linn, *Vigna radiate* Linn, and *Vigna ungiculata* Linn. Physicochemical characterization like foreign organic matter, ash value, swelling index, foaming index were determined for the selected *Vigna* genus plants.
Chapter –V:

This chapter describe about the collection, authentification, successive extraction process for the three *Vigna* genus selected plants, followed by qualitative phytochemical screening for the extracts which revealed the presence of alkaloids, triterpenoids, steroids, proteins, amino acids and carbohydrates in all the three *Vigna* genus plants.

Chapter-VI:

This chapter describes about the preliminary pharmacological screening of selected plant extracts on adult swiss albino mice.

The experimental protocol was approved by the Institutional animal ethical committee and by the regulatory body of the government (Regd No: 516/01/A/CPCSEA).

Acute toxicity studies were performed for the extracts of selected three *Vigna* genus plants according to the toxic classic method as per guidelines 423 prescribed by OECD. None of these extracts showed mortality even at dose of 1000mg/kg and therefore considered safe.

The doses selected for the extracts of *Vigna mung*Linn, *Vigna radiate*Linn, *Vigna ungiculata*Linn were about 1/10th and 1/20th of the maximum tolerated safe dose found from acute toxicity studies i.e., 1000mg/kg b.w.
Chapter-VII:

This chapter describes about the activity of selected plant extracts towards CCl4 induced liver damage model in Wister albino rats. After a continuous treatment of plant extracts at two divided doses i.e (100,50mg/kg b.w) for a period of 7 days twice daily and on 7th day after treatment with CCl4. Serum biochemical parameters SGOT, SGPT, ALP and TB were performed with the support of histopathological studies.

SPAN diagnostic reagent kits were used for the determination of SGOT, SGPT, ALP and TB in serum. The level of serum biochemical parameter have been presented as mean±SEM, n=6. The percentage decrease or increase was calculated by considering the difference in level of biochemical parameters between hepatoxin treated and control rats as 100% level reduction.

For the determination of significant inter group difference, each parameter was analysed separately and one way analysis of variance (ANOVA) was carried out. After that, individual comparisons of group mean values were done using Dunnet’s test.

Carbon tetrachloride (0.5ml/kg i.p) intoxication in normal rats elevated the levels of serum biochemical parameters SGOT (120.17±05.77 to 350.49 ±22.16), SGPT(106.76±03.78 to 394.02±16.54), ALKP (190.84±06.99 to 440.50±13.76) & Total bilirubin (1.58±0.20 to 4.71±0.51) significantly indicating that acute hepatocellular damage and biliary obstruction. The percentage reduction of various serum biochemical parameters in case of standard drug Silymarin
The ethanolic extract of *Vigna mung* Linn (50, 100 mg/kg p.o) on CCl₄ intoxicated rats revealed a high significant reduction (p<0.01) in the levels of SGOT (63.69%, 87.2%), SGPT (67.81%, 89.91%), ALKP (92.80%, 97.62%), TB (72.88, 76.71%). The chloroform extract of *Vigna mung*Linn (50, 100mg/kg p.o) on CCl₄ intoxicated rats revealed a high significant reduction (p<0.01) in the levels of SGOT (19.6%,25.74%) ,SGPT (28.89%,46.64%), ALKP (16.47%, 62.67%), TB (54.34%, 62.33%) where as Petroleum ether (50, 100mg/kg b.w) extract showed moderate significant percentage reduction when compared to other extracts, biological parameters are as follows SGOT (4.58%, 4.86%), SGPT (1.04%,13.22%), ALKP (5.62%, 13.25%), TB (24.61%, 49.54%).

The ethanolic extract of *Vigna radiata*Linn (50,100 mg/kg p.o) on CCl₄ intoxicated rats revealed a high significant reduction (p<0.01) in the levels of SGOT (68.06%, 89.87%), SGPT (68.92%, 80.76%), ALKP (97.22%, 100.84%), TB (66.16%, 78.95%). The chloroform extract of *Vigna mung* Linn (50, 100mg/kg p.o) on CCl₄ intoxicated rats revealed a high significant reduction (p<0.01) in the levels of SGOT (23.12%, 34.90%), SGPT (51.52, 52.91%), ALKP (17.67%,67.09%), TB (59.77%, 68.72%). Where as, petroleum ether (50, 100mg/kg b.w) extract showed moderate significant percentage reduction when compared to other extracts, biological parameters are as follows SGOT (3.92%, 13.08%), SGPT (0.69%, 20.19%), ALKP (8.83%, 18.48%), TB (46.34%, 51.78%).
The Ethanol extract of *Vigna uncinulata* Linn (50, 100 mg/kg p.o) on CCl₄ intoxicated rats revealed a high significant reduction (p<0.01) in the levels of SGOT (57.26%, 80.67%), SGPT (62.29%, 85.27%), ALKP (87.60%, 79.2%), TB (67.12%, 72.6%). The chloroform extract of *Vigna uncinulata* Linn (50, 100mg/kg p.o) on CCl₄ intoxicated rats revealed a high significant reduction (P<0.01) in the levels of SGOT(13.6%, 21.06%), SGPT (24.3, 42.78%), ALKP (13.86%, 52.13%), TB (51.14%, 57.53%). whereas petroleum ether (50, 100mg/kg b.w) extract showed moderate significant percentage reduction when compared to other extracts of *Vigna uncinulata* Linn, biological parameters are as follows SGOT (0.31%, 10.7%), SGPT (3.86%, 9.71%), ALKP (0.64%, 8.60%), TB (6.39%, 48.2%).

Histopathological studies of the liver section also supported hepatoprotective activity against CCl₄ intoxicant by recovery of damaged liver cells.

Hepatoprotective activity of *Vigna mung* Linn, *Vigna radiata* Linn, *Vigna uncinulata* Linn have been reported for the first time.

Chapter-VIII:

This chapter is divided into two parts

The first part deals with introduction of hyperlipidemia, etiology, symptoms, types of lipoproteins, pathways for the lipid metabolism inside the body.
The second part covers experimental procedure to evaluate anti hyperlipidemic activity of selected *Vigna* genus plant extracts towards cholesterol induced diet animal model at a dose of 100mg/kg b.w, using Atrovastatin as a standard drug(10mg/kg b.w) for a period of 20days.

The results were expressed by considering serum lipid parameters of serum total cholesterol (TC), serum triglycerides (TG), serum high density lipoprotein cholesterol (HDL), serum very low density lipoprotein cholesterol (VLDL), Serum low density lipoprotein cholesterol (LDL).

In normal rats treated with cholesterol induced diet showed lipid TC level on 21st day as (177.20±2.698 mg/dl) which was significantly higher (p<0.001) when compared to serum TC levels in normal control rats (64.89±2.280 mg/dl). Cholesterol induced hyperlipidemic rats treated with Atorvastatin (10mg/kg, p.o., once daily) for 20 days has shown serum TC level of (100.22±0.9657 mg/dl) on 21st day which was significantly lower (p<0.001) when compared to the serum TC levels in Cholesterol control rats (177.20±2.698 mg/dl). In the rats group treated with V.M.P.E, V.M.C.E, V.M.E.E at a dose of 100mg/kg b.w, showed serum TC levels as (175.61±2.314, 130.23±1.641, 169.11±2.412) respectively. In the rats group treated with V.R.P.E, V.R.C.E, V.R.E.E at a dose of 100mg/kg b.w, showed serum TC levels as (149.54±1.231, 125.21±1.895 and 146.46±3.669 mg/dl) respectively. In the rats group treated with V.U.P.E, V.U.C.E, V.U.E.E at a dose of 100mg/kg b.w, showed serum TC levels as (159.11±2.323, 128.31±0.234 and 153.21±2.713 mg/dl) respectively.
In normal rats treated with cholesterol induced diet showed lipid TG level on 21st day as (149.13±2.165 mg/dl) which was significantly higher (p<0.001) when compared to serum TG levels in normal control rats (53.90±1.66 mg/dl). Cholesterol induced hyperlipidemic rats treated with Atorvastatin (10mg/kg, p.o., once daily) has shown serum TG level of (93.95 ± 1.205mg/dl) on 21st day which was significantly lower (p<0.001) when compared to the serum TG levels in Cholesterol control rats (149.13±2.165 mg/dl) In the rats group treated with V.M.P.E, V.M.C.E, V.M.E.E at a dose of 100mg/kg b.w, showed serum TG levels as (155.12 ±1.321, 117.24±2.464 and 140.21±2.314 mg/dl) respectively. In the rats group treated with V.R.P.E, V.R.C.E, V.R.E.E at a dose of 100mg/kg b.w, showed serum TG levels as (129.23±3.205, 106.45±2.906 and 125.75±3.978 mg/dl) respectively. In the rats group treated with V.U.P.E, V.U.C.E, V.U.E.E at a dose of 100mg/kg b.w, showed serum TG levels as (142.14±2.516, 110.32±2.314 and 134.24±4.614mg/dl) respectively.

Rats fed with Cholesterol for 20 days had serum HDL-C level of (20.71±1.221 mg/dl) when measured on 21st day .This was significantly lower (p<0.001) when compared to serum HDL-C levels in normal control rats (36.15±1.125 mg/dl). Cholesterol induced hyperlipidemic rats treated with Atorvastatin (10mg/kg, p.o., once daily) had serum HDL-C level of (32.51±0.7098 mg/dl). Cholesterol induced hyperlipidemic rats treated with V.M.P.E, V.M.C.E, V.M.E.E 100mg/kg b.w p.o, once daily, had serum HDL-C level of 16.23 ± 0.148, 28.11 ± 0.631 and 20.14 ±0.145 mg/dl respectively. Cholesterol induced hyperlipidemic rats treated with V.R.P.E, V.R.C.E, V.R.E.E
Summary

100mg/kg b.w p.o, once daily, had serum HDL-C level of (23.22±0.412, 32.97±0.3054 and 28.12±1.546 mg/dl) respectively. Cholesterol induced hyperlipidemic rats treated with V.U.P.E, V.U.C.E, V.U.E.E 100mg/kg b.w p.o, once daily, had serum HDL-C level of (30.07±0.611, 33.01±0.514 and 32.34±1.643mg/dl) respectively.

Rats fed with Cholesterol for 20 days had serum VLDL-C level of (29.23±0.4326 mg/dl) when measured on day 21. This was significantly higher (p<0.001) when compared to serum VLDL-C levels in normal control rats (11.76±0.3387 mg/dl). Cholesterol induced hyperlipidemic rats treated with Atorvastatin (10mg/kg, p.o) had serum VLDL-C level of 18.78±0.2407 mg/dl when measured on day 21, showing lower significant change (p<0.001) when compared to the serum VLDL-C levels in Cholesterol control rats (29.23±0.4326mg/dl). Cholesterol induced hyperlipidemic rats treated with V.M.P.E, V.M.C.E , V.M.E.E 100mg/kg b.w p.o, once daily, had serum VLDL-C level of (36.41±0.552, 25.34±0.414 and 30.24±0.326 mg/dl) respectively. Cholesterol induced hyperlipidemic rats treated with V.R.P.E, V.R.C.E , V.R.E.E 100mg/kg b.w p.o, once daily, had serum VLDL-C level of (29.52±0.6128, 20.68±0.5916 and 25.66±0.7609 mg/dl) respectively. Cholesterol induced hyperlipidemic rats treated with V.U.P.E, V.U.C.E, V.U.E.E 100mg/kg b.w p.o, once daily, had serum VLDL-C level of (30.11±0.516, 24.73±0.234 and 31.23±0.5412 mg/dl) respectively.

Rats fed with Cholesterol for 20 days had serum LDL-C level of (116.26±3.507 mg/dl) when measured on day 21. This was significantly higher...
Summary

(p<0.001) when compared to serum LDL-C levels in normal control rats (16.00±2.656 mg/dl). Cholesterol induced hyperlipidemic rats treated with Atorvastatin (10mg/kg, p.o., once daily) had serum LDL-C level of (48.89±0.7986 mg/dl) when measured on day 21. This was significantly lower (p<0.001) when compared to the serum LDL-C levels in Cholesterol control rats (116.26±3.507 mg/dl). Cholesterol induced hyperlipidemic rats treated with V.M.P.E, V.M.C.E, V.M.E.E 100mg/kg b.w p.o, once daily, had serum LDL-C level of (119.63±0.143, 88.61±0.241 and 110.23±0.341 mg/dl) respectively. Rats treated with V.R.P.E, V.R.C.E, V.R.E.E 100mg/kg b.w p.o, once daily, had serum LDL-C level of (104.21±0.231, 75.55±1.561 and 95.77±3.825 mg/dl) respectively. Cholesterol induced hyperlipidemic rats treated with V.U.P.E, V.U.C.E, V.U.E.E 100mg/kg b.w p.o, once daily, had serum LDL-C level of (106.33±1.45, 79.56±0.321 and 102.21±4.312 mg/dl) respectively.

Treatment with *Vigna* genus selected plant extracts significantly reduced serum and tissue cholesterol, LDL-C, VLDL-C levels and triglyceride levels are the important finding of this experiment. Treatment with *Vigna* genus selected plant extracts showed significant decreased in triglyceride. HDL is considered to be a beneficial lipoprotein as it has an inhibitory effect in the pathogenesis of atherosclerosis. Low level of HDL is associated with high risk of coronary artery disease. In the present study HDL-C level in serum were significantly increased by chloroform extract and Ethanolic extracts of all the selected plants.

*Vigna radiate* Linn chloroform extract possess highly significant action towards reducing the body cholesterol. Hence the folklore usage has been
Summary

validated. *Vigna* genus selected plants can be treated as Nutraceuticals, as these plants contain high amount of dietary fiber it is helpful to reduce body cholesterol level as well as a rich nutrition food.

Chapter-IX:

This chapter is divided into two parts

The first part deals with the introduction to free radical, antioxidants and types of antioxidants and their mechanism.

The second part deals with the experimental procedure for *In vitro* antioxidant activity of the extracts of the selected *Vigna* genus plants, *Vigna mung* Linn, *Vigna radiate* Linn and *Vigna unguiculata* Linn and known antioxidant ascorbic acid used as a standard in scavenging free radicals in DPPH, NO, ABTS+ models, followed by their results and discussion.

**DPPH radical scavenging activity**

This activity was determined by the IC$_{50}$ values of extracts of selected three plants and ascorbic acid. The lower the IC$_{50}$ values, the higher is the free radical scavenging ability. The mean IC$_{50}$ values for DPPH radical scavenging with ascorbic acid was found to be 70 µg/ml, V.M.P.E 120 µg/ml, V.M.C.E, V.M.E.E were found to be 75, 68 µg/ml respectively. Mean IC$_{50}$ value of V.R.P.E was found to be 397µg/ml where as V.R.C.E, V.R.E.E were found to be 98, 81 µg/ml respectively. The concentration V.U.P.E needed for 50% inhibition was
found to be 360 µg/ml where as V.U.C.E, V.U.E.E were found to be 90, 60 µg/ml respectively.

NO radical scavenging activity

This activity was determined by the IC$_{50}$ values of extracts of selected three plants and ascorbic acid. The mean IC$_{50}$ values for NO radical scavenging with ascorbic acid was found to be 180 µg/ml. V.M.P.E 440 µg/ml, V.M.C.E, V.M.E.E were found to be 370, 180 µg/ml respectively. V.R.P.E 480 µg/ml, V.R.C.E, V.R.E.E were found to be 350, 150 µg/ml respectively. Concentration of V.U.P.E needed for 50% inhibition was found to be 492 µg/ml where as V.U.C.E, V.U.E.E were found to be 397, 286 µg/ml respectively.

ABTS$^+$ radical scavenging activity

This activity was determined by the IC$_{50}$ values of extracts of selected three plants and ascorbic acid. The mean IC$_{50}$ values for ABTS$^+$ radical scavenging with ascorbic acid was found to be 198 µg/ml. V.M.P.E 494 µg/ml, V.M.C.E, V.M.E.E were found to be 399, 203 µg/ml respectively V.R.P.E 490 µg/ml, V.R.C.E, V.R.E.E were found to be 410,390 µg/ml respectively. V.U.P.E needed for 50% inhibition was found to be 496 µg/ml where as V.U.C.E, V.U.E.E were found to be 381, 340 µg/ml respectively.
CONCLUSION:

Present data obtained from the pharmacognostic studies of three Vigna genus plants, *Vigna mung* Linn, *Vigna radiate* Linn, *Vigna unguiculata* Linn can be an important identification tool for standardization of these plants. The pharmacological studies carried on these plants are validating the traditional usages and can be concluded to use these plants in hepatic infection, for decreasing the hyperlipidemic condition of the body as these pharmacological studies are supported by the *In vitro* antioxidant studies by DPPH, NO, ABTS\(^+\) models.

FUTURE SCOPE:

Future scope demands that there is a need for the isolation of the constituents responsible for the pharmacological action and to screen the exact mechanism of action, for the curative purpose.