

## 5. SUMMARY AND CONCLUSION

Nature is a warehouse for various plants with medicinal properties. It can be used to treat all diseases because of its least or no side effects in human beings. Medicinal importance of the plants depends on the presence of some phytochemical constituents. There is a great demand for herbal medicine in the developed as well as developing countries, because of their wide biological activities, higher margin of safety than the synthetic drugs and lesser costs.

Cardiovascular disease, one of the non-communicable diseases, has become a major public health problem in many developing countries. Cardiovascular disease caused by blood clot (thrombus) formation is one among the most severely affecting diseases. Commercial medicines such as streptokinase, clopidogrel, heparin, aspirin etc are used widely but with many side effects including haemorrhage. To combat the shortcomings of the available thrombolytic agents, there is an inclination towards herbal based medicines.

The present study was carried out to investigate thrombolytic and antioxidant properties in the leaves and flowers of *Moringa pterygosperma* Gaertn. An *in vitro* thrombolytic method was used to evaluate the thrombolytic activity of the plant extracts using human blood samples from healthy volunteers. The antioxidant potential was established by the analysis of enzymic and non-enzymic antioxidants and total antioxidant capacity. HPTLC screening was performed to analyze the different phytochemicals present in the leaves and flowers of *Moringa pterygosperma* Gaertn.. Total cholesterol was estimated in serum obtained from blood samples used for clot lysis and a comparison was made between the serum cholesterol level and percent clot lysis. To further confirm the thrombolytic potency of the selected plant *in silico* characterization was performed with selected ligands in the plant and few target proteins accountable for thrombolysis.

- ❖ The preliminary phytochemical analysis of the leaves and flowers of the *Moringa pterygosperma* Gaertn. showed the presence of carbohydrates, proteins, phenols, tannins, steroids, alkaloids, saponins and terpenoids. Quinones were found to be absent in all the extracts of both leaves and flowers of *Moringa pterygosperma* Gaertn.. A quantitative estimation of phytoconstituents such as carbohydrates, proteins, phenols, alkaloids and flavonoids was performed and the leaves showed higher concentration of these phytoconstituents when compared to the flowers.

- ❖ HPTLC analysis was carried out to determine the bioactive compounds present in the sample. The different solvent extracts of leaves and flowers of *Moringa pterygosperma* Gaertn. were used for the screening of phytoconstituents namely alkaloids, flavonoids and phenols. The results revealed the presence of flavonoids, phenols and alkaloids. While the flavonoids and phenols exhibited a peak similar to the standard used, there was no peak corresponding to the standard colchicines in case of alkaloids. But the mere presence of different bands confirms the presence of other alkaloids.
- ❖ The antioxidant capacity and the level of both enzymic and non enzymic antioxidants were found to be greater in leaves of *Moringa pterygosperma* Gaertn.. Both the leaves and flowers of *Moringa pterygosperma* Gaertn. exhibited an increasing trend in the total antioxidant capacity increased with the increase in concentration of the extracts
- ❖ Leaves and flowers of *Moringa pterygosperma* Gaertn. exhibited a noteworthy clot lysing ability. Comparison of percent clot lysis among leaves and flowers of *Moringa pterygosperma* Gaertn. revealed that the leaves have a better thrombolytic activity than the flower and similarly, aqueous extract of both leaves and flowers showed a slight elevation in thrombolytic activity compared to the other extracts. The higher levels of enzymic and non-enzic antioxidants in the leaves could be considered the main players for the better thrombolytic activity in leaves.
- ❖ Total cholesterol was estimated in serum obtained from blood samples used for clot lysis and compared with percent thrombolysis. Correlation analysis was carried out by comparing the serum cholesterol level and percentage clot lysis by the plant extracts. The results revealed no correlation between cholesterol level and thrombolysis of different solvent extracts of both leaves and flowers of *Moringa Pterygosperma* Gaertn. suggesting that the plant can lyse the clot irrespective of the cause of clot formation and the cholesterol levels.
- ❖ *In silico* study was carried out with the selected ligands from *Moringa pterygosperma* Gaertn. to analyze their efficacy against proteins involved in blood clotting mechanism in humans. The structure of target proteins namely Factor IXa, Factor Xa, thrombin and plasmin was retrieved from Protein Data Bank. The characterization of active component was performed by molecular docking and ADME studies. Multiflorin B possessed good docking scores and high binding affinity. The ADME studies supported the bioavailability of all the ligands. *In silico*

studies revealed strong interaction of selected ligands such as quercetin, isoquercetin, kaempferol, apigenin, multiflorin B with the target proteins namely FacIXa, FacXa, Plasmin and Thrombin suggesting their vital role in thrombolytic effect.

The findings of the present study suggest that the thrombolytic activity and the antioxidant potential of the leaves and flowers of *Moringa pterygosperma* Gaertn. could be considered as a promising source for the development of cardioprotective drug and chemotherapeutic agents. The present research investigated not only the thrombolytic effects of the selected plant but also the probable mechanism, through *in silico* docking model, of how they are involved in such biological actions.

**Future recommendations:**

- Dose optimization can be performed by analyzing the optimal concentration required for effective thrombolysis in the selected plant.
- The active components present in the leaves and flowers of *Moringa pterygosperma* Gaertn. can be isolated, purified and characterized.
- The crude extracts of the leaves and flowers of *Moringa pterygosperma* Gaertn. along with the isolated compound/s responsible for thrombolysis can be evaluated *in vivo* using rat models.
- The combinatorial effect of both the leaves and flowers of *Moringa pterygosperma* Gaertn. can be studied both *in vitro* and *in vivo*.