

Exploring the potential of *Blumea lacera* (Burm.F.) Dc as an anti-haemorrhoid agent



**Thesis submitted in partial fulfillment
for the Award of Degree
Doctor of Philosophy**

By

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Year: 2023

SUMMARY

7. Summary

The current investigation was primarily conducted with the aim of validating the plant *Blumea lacera burm f. (DC)* for its anti-hemorrhoid activity. The anti-hemorrhoid activity and Antioxidant activities were evaluated through validated models of *in vitro* and *in vivo* studies. The imperative findings of this scientific investigation are summarized and concluded as follows:

- EBL was effective in COP induced hemorrhoid as observed in pilex treated animals. Histopathological study of recto-anal sections further collaborates these findings as significant healing of lesions is observed with, at doses, 100, 200 and 400 mg/kg, p.o. of EBL.
- EBL at 400 mg/ kg, p.o. was qualitatively similar to the standard drug, pilex (200 mg/ kg, p.o.) in treating hemorrhoid.
- The significant dose-dependent decrease by EBL in the MDA concentration confirms that treatment with EBL could effectively protect against the lipid peroxidation induced by COP.
- The COP induced decrease in levels of Catalase and SOD was significantly reversed by EBL. A dose-dependent increase in levels of these enzymes was observed and EBL at 400 mg/ kg, p.o. was found quantitatively similar to that of pilex.

The results of present investigations indicated that EBL has significant anti-hemorrhoid activity but the dose was high as extract had less bioavailability indicated by pharmacodynamic observations.

Therefore, we intended to resolve the above presented problem possessed by the extract, therefore five different fractions were prepared using standardized EBL and quantitative estimation of various phytoconstituents in all the fractions under investigation was performed. Further, the *in vitro* anti-inflammatory and antioxidant potential of all the fractions was also assessed. The ethyl acetate fraction (EAF) was found to have highest amount of phytosterol along with significant anti-inflammatory and anti-oxidant potential among all the other fractions. Based on the above findings, the EAF was selected for the development of silver nanoparticles (PLSNPs).

The outcomes of this study are presented below:

- EAF possessed high amount of phytosterols as compared to other fractions evidenced through quantitative estimation which was further supported by the findings of HPTLC and HPLC.
- EAF was found to be most active fraction as it demonstrated significant efficacy when tested for *in vitro* anti-inflammatory and anti-oxidant activity.
- The phytoconstituents present in EAF could be utilized for treating haemorrhoids which might be attributed to its strong anti-inflammatory activity as evidenced by the *in silico* molecular docking results.
- The PLSNPs, prepared using EAF were found to be around 86 nm in size with almost spherical shape and demonstrated potent anti-oxidant, anti-inflammatory, anti-bacterial activity at comparatively lesser dose than that of ethanolic extract.

The results of present investigations showed that the PLSNPs might be a potent anti-haemorrhoid agent which may act at comparatively lesser dose.

Furthermore, the toxicological profiling of PLSNPs were evaluated which is crucial for determining long term safety and efficacy of any drug like moiety. Thereafter, the anti-haemorrhoid potential of PLSNPs was evaluated by means of COP induced haemorrhoids in rat model.

From the above study, the following inferences can be drawn:

- PLSNPs could be used safely for long term as they presented neither any mortality nor any significant sign of behavioral toxicity, also, no alteration in biochemical and haematological parameters was observed when administered at high doses (1000 mg/kg; p.o.). These findings were also supported by histopathological study.
- PLSNPs were effective in COP induced hemorrhoid at half dose (200 mg/kg; p.o.) as compared to EBL (400 mg/kg; p.o.) and the results were comparable to the standard drug. Histopathological study of recto-anal sections further corroborates these findings as significant healing of lesions is observed at doses, 100 and 200 mg/kg, p.o. of PLSNPs.
- The PLSNPs were effective in ameliorating the oxidative stress generated by haemorrhoidal tissues in its pathophysiological state as the PLSNPs (100 and 200 mg/kg, p.o.) were able to restore the altered LPO, SOD and Catalase levels in *in vivo* anti-oxidant assay.

In conclusion, the EBL (ethanolic extract of *Blumea lacera*) can be used as a better alternative in ameliorating the impact of haemorrhoids. Whereas, the PLSNPs developed using EAF (phytosterol enriched fraction from EBL) could be explored as potent alternate in treating pathological hamorrhoids at comparatively lesser dose. The high degree of

curative effect exhibited by PLSNPs may be attributed to its significant anti-inflammatory potential. In future, the in-depth molecular studies are required to unveil the exact mechanism behind the anti-haemorrhoid effect exhibited by PLSNPs.