6.0. SUMMARY AND CONCLUSION

6.1. Summary

The process of wound healing is complex and is influenced by various extrinsic and intrinsic factors. Therefore, the management of chronic wounds become problematic. In the recent years, the usage of traditional medicines in the treatment of such injuries is in practice. This practice is because the traditional polymolecular medicine has many advantageous effects compared to a single molecule based allopathic medicine in several instances. However, there are rarely any studies that have been carried out to explain the exact cellular, biochemical and molecular mechanisms involved in wound healing by the medicinal preparations. Further, the involvement of the traditional medicines in the treatment of chronic wounds such as diabetic wounds is less explored.

The present study, therefore, intended to scientifically evaluate the fundamental mechanisms of wound healing by the topical application of a few selectively chosen medicinal preparations, i.e., Honey, Ghee, GG, and NI. These test materials were selected owing to their healing benefits mentioned in Ayurveda and Indian folk medicine. The healing abilities of these medications were studied singly and in combination. Further, we tried to explore the healing effects on both normal and diabetic groups. The study has made a sincere attempt to provide an understanding of the actual healing process, the mechanisms of which otherwise remains elusive.

The biomechanical analysis showed better healing benefits of these traditional medicines. Histological analysis showed better epithelization, increased vascularity, good collagen rearrangement, and thus better healing at the wound site in all the
treated groups compared to control. Biochemical analysis showed better antioxidant properties of the test materials which were helpful in reducing the activity of ROS at the wound site, thereby preventing tissue damage and glorifying the rejuvenating properties of these traditional medicines. IHC-HRP studies focused on the myofibroblasts and IL1-beta expression which are crucial in the process of healing. Further, the enhanced expression of genes/ growth factors like TGF β, FGF2, VEGF and PDGF in the groups treated with the traditional medicines also affirmed their wound healing benefits. The preliminary results obtained from the cell culture experiments also proved the efficacy of these natural wound healing compounds.

Honey proved to be an effective choice for healing diabetic wounds. It worked more efficiently on diabetic wounds compared to normal! It emerged to be an “all in one” medication for healing diabetic wounds. This unique healing nature of honey was attributed to its antimicrobial and antioxidant activity. It also played an influential role in the control of inflammation. The use of Ghee was although useful in normal wounds due to its influence on the increased vascularity, however, lagged behind in the treatment of the diabetic wounds when compared to the other groups. GG emerged as a potent healer both in normal and diabetic wound owing to its influence on growth factors, increased vascularity & rejuvenating effects. NI had its impact on the wound tensile strength, growth factors and inflammatory cells at the wound site thereby improving the healing. H+G and Tot had a combined effect of the test materials involved in the wound healing process. This observation was denoted by early inflammatory responses, rapid epithelization, the growth of hair follicles, better collagen rearrangement and wound remodeling.
6.2. Conclusion

The present study, therefore, concludes that these traditional medicines singly and in combination can play a vital role in treating and managing the medically challenging wounds.

The study helps to provide scientific explanations to the mode of action of these traditional medicines singly and in combination which have frequently been used in India.

This evidence provides an increased value to the efficacy of the traditional Indian medicines in the national and international scenario.

Additionally, the findings derived from the present study may serve as the stepping stones for further evaluation of various other intricate mechanisms which may aid in the development of new approaches to the treatment of medically challenging wounds.

6.3. Scope for Future work

The molecular mechanism of actions such as different pathways involved, cross-talk between molecules can be further explored using various other experimental models such as co-cultures of keratinocyte–fibroblast, 3D skin cultures, etc.

The assessment of the effect of these medications on the survival and proliferation of the cells such as fibroblasts and keratinocytes in hyperglycemic conditions may also be useful. It would help in providing appropriate information to explain the behavior of these cells in chronic wounds such as diabetic ulcers.
The best combinations with appropriate amounts of the test materials may be used to prepare more effective medicines for treating the wounds by making the medicine-coated bandages/band-aids.

Comparison of the healing benefits & mechanisms of Honey, Ghee, GG and NI (singly and in combination) with the standard mode of treatment (allopathic) for wound healing.