



Summary and Conclusion

5.0 SUMMARY AND CONCLUSION

Since time immemorial man has been using plant extracts to protect himself against several diseases and also to improve his health and life-style. No doubt, plants are serving several purposes whether health, nutrition or medicinal. With the development in techniques and recent researches, it has been proved that certain non-nutritive chemicals in plants such as terpenoids and flavonoids which were earlier thought to be of no importance to human diet possess antioxidant properties.

The plants are susceptible to damage caused by active oxygen and thus develop numerous antioxidant defence system resulting in formation of numerous potent antioxidants. Many aromatic, medicinal and spice plants contain compounds that possess confirmed strong antioxidative components. The essential oils derived from aromatic plants not only serve as fragrance and flavour agents but also as dietary antioxidants expected to prevent several diseases caused by free radicals.

Hence only in the last few decades studies are focussed in research of *Citrullus colocynthis* fruit that could serve as a source of antioxidants which could be taken up by mankind to boost their general well being.

The present investigation entitled, '**A comparative study on the antioxidant properties of unripe and ripe fruits of *Citrullus colocynthis* (Linn.)**' was carried out with the objective of estimating the levels of enzymic and non-enzymic antioxidants in the unripe and ripe fruits of *Citrullus colocynthis* and to study the free radical scavenging effect in the unripe and ripe fruits of *Citrullus colocynthis*.

Unripe and ripe fruits of *Citrullus colocynthis* (bitter apple) were collected from the local market in Coimbatore and then shade dried. They were then powdered for the antioxidant studies. The extraction was done in

distilled water, methanol and petroleum ether for determining the free radical scavenging activity of the unripe and the ripe fruits.

The parameters analyzed were enzymic antioxidants (catalase, peroxidase, superoxide dismutase and glutathione reductase) and non- enzymic antioxidant (reduced glutathione, ascorbic acid, carotenoids and tocopherol). The free radical scavenging effect was studied *in vitro* with various methods (DDPH scavenging assay, ABTS scavenging assay, hydroxyl radical scavenging, *in vitro* hydrogen peroxide and *in vitro* superoxide generation assays) in the unripe and ripe fruits of *Citrullus colocynthis*.

All the enzymic antioxidants, namely catalase, peroxidase, superoxide dismutase and glutathione reductase assayed showed significantly higher ($p < 0.05$) activity in the ripe fruit *Citrullus colocynthis* than the unripe fruit indicating an increase in the activity during ripening. The activity of catalase showed the most rapid increase while the levels of peroxidase, superoxide dismutase and glutathione reductase levels were elevated to a lesser extent.

Of the non- enzymic antioxidants like reduced glutathione, ascorbic acid, carotenoids and tocopherol studies in selected unripe and ripe fruits of *Citrullus colocynthis*, carotenoid showed a remarkable increase in the ripe fruits followed by reduced glutathione, tocopherol and ascorbic acid. Hence, ripening leads to an increase in all the enzymic and the non- enzymic antioxidant.

The results of the study on *in vitro* free radical scavenging effect on the unripe and ripe fruits of *Citrullus colocynthis* revealed that ripe fruits of methanolic extract showed the highest scavenging in DPPH and ABTS scavenging assays. It was found that of the three extracts (aqueous, methanol, petroleum ether) the methanolic extract showed the highest percentage of scavenging in the methanolic extract of the ripe fruits in *Citrullus colocynthis*. This was followed by high scavenging percentage in petroleum ether and the least in the aqueous extract.

Percentage inhibition of *in vitro* hydrogen peroxide, superoxide and the hydroxyl radical scavenging effect was found to be in a similar pattern with a high percentage of scavenging effect in the methanolic extract of the ripe fruit when compared to petroleum ether and the aqueous extracts of *Citrullus colocynthis*.

In summary, the results of the present study showed that the ripe fruits of *Citrullus colocynthis* (bitter apple) showed a high activity of both enzymic and non- enzymic antioxidants. The methanolic extract of the ripe fruit, showed the maximum antioxidant activity followed by the extraction in petroleum ether and finally the aqueous extraction which recorded the lowest activity. In assaying the *in vitro* free radical scavenging on the unripe and ripe fruits of *Citrullus colocynthis*, DDPH and ABTS showed similar results where methanol revealed maximum scavenging effect in the ripe fruits when compared to the unripe fruits. Hydrogen peroxide, superoxide and the hydroxyl radical scavenging effect also showed that the ripe fruits of *Citrullus colocynthis* methanolic extract had the highest percentage of scavenging.

To conclude, it can be stated that the methanolic extract of the ripe fruit of *Citrullus colocynthis* serves as an effective source of enzymic and non- enzymic antioxidants and is therefore a valuable fruit with excellent medicinal values.

RECOMMENDATION FOR FUTURE RESEARCH

The observations made and the results obtained in the present study, led to the formulation of the following recommendation for further research.

℞ Aqueous, organic and other extracts of the fruit of *Citrullus colocynthis* can be tested for assessing their anticytotoxic and antigenotoxic potential using microbial testing systems and mammalian tissue culture.

- ℞ The active principle responsible for the antioxidant activity of *Citrullus colocynthis* can be identified, isolated and purified
- ℞ The *Citrullus colocynthis* fruit is a natural source in increasing fertility. Hence, further work on identification, isolation and purification of the enzymes related to fertility can be studied and carried out in future.