CHAPTER 6

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GENERAL DISCUSSIONS AND CONCLUSION

The treatment of diseases using plant medicines is part of human culture which continues to play a major role in the health care systems worldwide. Many of the pharmaceuticals currently available to physicians have a long history of use as herbal remedies. The World Health Organization (WHO) estimates that 80% of the world's population presently use herbal medicine for some aspect of primary health care (WHO, 2009). The herbal medicines have, for years, proved to be highly effective and less toxic than synthetic medicines. This reason, together with the persistence of chronic side effects of some synthetic drugs, have lead to the growth of interest on the use of herbal medicines especially in the developed countries (Atal, 1983; Fabricant and Farnsworth, 2001; Erasto 2006). In Sub-Saharan Africa, however, the reliance on plant medicines is mainly influenced by the cost and unavailability of modern drugs, particularly in the rural areas. As a result, use of medicinal plants contribute immensely to the primary health care of the people (Erasto 2006). The continuous use and the growing demand for herbal therapies have invigorated the quest for validating the efficacy and safety or toxic implications of medicinal plants. Also, the growing threat of extinction of some species due to over harvesting, uprooting, and the diminishing knowledge on medicinal plant usage have necessitated the use of leaves and stems as alternatives to tubers and roots for medicinal purposes, and the documentation of valuable information on traditional pharmacopoeias. This would help in developing safe and cheap alternative medicines and also protect endangered plant species.

In this study, 10 plant species used for the treatment of alcohol-induced liver damage in Nkonkobe Municipality, Eastern Cape Province of South Africa were documented. *Pelargonium reniforme*, one of the species identified during the ethnobotanical survey was chosen for further phytomedical investigations. The main objective was to validate the ethnomedical uses of this

plant by carrying out alcohol-induced hepatotoxicity studies and by antimicrobial and antioxidant analyses. The results of this study were expected to provide valuable information on the medicinal values of this plant to the scientific society, medical practitioners, traditional healers and the communities which use the plant for medicinal purposes.

Ethnobotanical survey

The ethnobotanical survey carried out at the beginning of the study showed 10 plant species commonly used for the treatment of alcohol-induced liver damage in Nkonkobe Municipality (Chapter Two). The plants belong to seven different families. Different parts of plants are used by the local traditional healers for the treatment of alcohol-induced liver problems. These include the roots (40%), leaves (30%), bulb (10%), rhizome (10%) and stem (10%). Decoctions and infusions are the methods of preparation and the remedies are taken orally and continuously until the patient is healed.

Most of the people in the Eastern Cape Province are rural dwellers, hence the use of plants for various diseases is very common. For instance, many of the plants which were identified in this survey have also been reported to be used in the treatment of other ailments such as fever, to expel intestinal worms, influenza, colds, asthma, tuberculosis, stomach problems and cancer (Treurnicht, 1997). This survey has shown the vital roles that medicinal plants play in the primary health care of the people, especially in the treatment of alcohol-induced liver damage, particularly in the rural areas. However, the need arises for future researchers to focus on detailed scientific studies of these plants in order to validate their traditional uses.

Alcohol-induced hepatotoxicity studies and antioxidant assays

Excess alcohol consumption has been linked with altered liver metabolism and liver damage, with leakage of cytoplasmic liver enzymes into the blood (James WPT, 1993), some of which include AST, ALT, ALP and GGT. The increased levels of these enzymes (AST, ALT ALP and GGT) in the serum were observed in alcohol administered rats, which indicate increased permeability, damage and necrosis of hepatocytes (Goldberg and Watts, 1965). Pretreatment with the extract of *P. reniforme* significantly decreased levels of serum enzyme markers, thus suggesting that the extract possessed compounds that protected the hepatocytes from alcohol-induced liver injury and subsequent leakage of the enzymes into the circulation. Decreased levels of the enzyme markers in the post-treated group compared to control were an indication that the extract also possessed a curative effect (Chapter Three). Serum bilirubin is one of the most sensitive tests employed in the diagnosis of hepatic diseases. It provides useful information on how well the liver is functioning (Saravanan et al., 2006). Decrease in serum bilirubin after treatment with *P. reniforme* indicated the effectiveness of the drug in the maintenance of normal functional status of the liver. A significant decrease in the level of the serum total proteins, also indicate malfunctioning of the liver. Stabilization of serum protein levels in the pre and post-treatment groups administered with *P. reniforme* is further a clear indication of the improvement of the functional status of the liver cells.

Aqueous root extracts from *P. reniforme* showed a high level of phenolic compounds (flavonoids, flavonols, phenols and proanthocyanidins). They also exhibited high antioxidant activity as shown through their DPPH and ABTS radical scavenging as well as reducing power (Chapter Three). Phenolic compounds are very important plant constituents because of their free radical scavenging ability due to their hydroxyl groups (Hatano et al., 1989). These compounds

may contribute directly to antioxidant action and the removal and neutralization of noxious toxic metabolites which are produced when alcohol is abused. The reducing capacity of a compound also contributes to its antioxidant capacity. It can be observed that the content of phenolic compounds of *P. reniforme* could be responsible for the radical scavenging activity and this may also explain the observed protection of the liver cells from damage and the improvement in the functional status of the cells after damage.

The two assays further justify the traditional use of this plant in the treatment of alcohol-induced liver damage.

Comparative antibacterial, antifungal and antioxidant activity of the roots and leaves of *P. reniforme*

Pathogens such as bacteria and fungi are implicated in alcoholic liver damage. Despite the widespread use of broad spectrum antibiotics, bacterial infection is responsible for up to a quarter of the deaths of patients with liver disease (Wyke, 1987). Fungal infection has been identified as an important cause of morbidity and mortality in patients with acute liver failure. Fungal colonisation of superficial mucosal sites usually precedes invasive infection (Fisher et al., 1998).

Acetone, methanol and water extracts from the roots and leaves showed antibacterial (with better activity observed against Gram-positive bacteria) and antifungal activity. The results suggest that compounds identified in the roots of the plant may be similarly present in the leaves but with different concentrations of active compounds. The choice of the root by the traditional healers over the leaves may be arbitrary or due to easy collection. The leaves of *P. reniforme* may, as well substitute for its roots in medicinal formulations especially in the treatment of liver diseases

and this may help reduce the threatened extinction of the plant which is likely to occur as a result of uprooting to obtain the roots (Chapter Four).

Also, a comparative study of the antioxidant activity of extracts from the leaves and roots showed antioxidant activity which was concentration dependent. This may suggest that similar antioxidant compounds are found in both the leaves and the roots. These results imply that *P. reniforme* leaves may substitute for its roots in medicinal formulations especially in the treatment of liver diseases.

Safety evaluation studies

Pelargonium reniforme Curtis is a herb used for the treatment of various human and animal diseases including liver diseases especially in the Eastern Cape of South Africa. The effect of the administration of the extract was observed on several haematological parameters, liver and kidney function indices as well as the relative weights of some organs in male wistar rats. The available results of this study suggest that the aqueous root extract of *P. reniforme* is not toxic at the doses used in this study and therefore safe for medicinal uses. This also justifies its use in traditional medicine.

The results of this study show that *P. reniforme* is safe for medicinal uses. It also strongly supports the traditional uses of the plant for the treatment of alcohol-induced liver damage and other infectious diseases. The study has also demonstrated the importance of validating the ethnomedical uses of plants as this can provide the basis for their continued use and the

development of herbal medicines which would facilitate their integration into the modern medical systems.

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