



Introduction

1.0 INTRODUCTION

From ancient times, around the globe, people have relied historically and continue to rely on medicinal plants for primary health care. There is currently a worldwide upsurge in the use of herbal preparations and the active ingredients isolated from medicinal plants in health care. Plant-based drugs have been used worldwide in traditional medicines for the treatment of various diseases. Approximately 60% of the world's population still relies on medicinal plants for their well being. There is a long history of the medicinal uses of plants in Asian countries, some of which have proved useful to humans as pharmaceuticals (Hafidh *et al.*, 2009).

Traditional herbal medicines form an important part of the medical system in India. Ayurveda, supposed to be the oldest medical system in the world provides potential leads to find active and therapeutically useful compounds from plants (Ali *et al.*, 2008). Herbs and spices have been added to different types of foods to impart flavour as well as to improve storage stability. Many herbs and spices have shown to have antioxidant effects in food. Medicinal plants have been traditionally used in the treatment of several human diseases and their pharmacological and therapeutic properties have been attributed to different chemical constituents isolated from their crude extracts (Jayaprakasha *et al.*, 2007).

Natural products derived from foods and medicinal plants are the potential sources of antioxidants (Erasto and Mbwambo, 2009). Foods naturally contain antioxidants but are not super-rich in calories, namely, fruits, vegetables and grain. These natural foods help to maintain human health and delay disease onset (Gutteridge and Halliwell, 2010).

Plants may be considered as good sources of natural antioxidants for medicinal uses such as against ageing and other diseases. These natural products are likely to be a richer source of multipotent antioxidants than the approved drugs. Nevertheless, we think the presently identified natural multifunctional antioxidants represent only the tip of the iceberg. It can be expected that, as knowledge on natural medicines continues to increase, more and more multifunctional antioxidants will be discovered. Therefore, searching for multipotent antioxidants in compound libraries, especially natural-product collections, could prove to be a highly fruitful approach (Zhang *et al.*, 2006).

Determination of the natural antioxidant compounds of plant extracts will help to develop new drug candidates for antioxidant therapy (Sendogdu *et al.*, 2006). Antioxidants are the most vital substances that possess the ability to protect the body from damage caused by free radical induced oxidative stress. A variety of free radical scavenging antioxidants exist within the body which many of them are derived from dietary sources like fruits, vegetables and teas (Souri *et al.*, 2008)

The rich world of herbs, with thousands of species and varieties, demands study. The phenolic composition and antioxidant activity of wild and cultivated plants especially need investigation. However, there are few reports about these proprieties in other plants. Although extensive studies on bioactive compounds and their total content in many species have already been carried out, the phenolic identification data are still insufficient and incomplete in particular, quantitative data on phenolics in the species are still missing. Fruits and vegetables are usually mentioned as primary sources of phenolic compounds in food but different cereals may be a good source of phenolic compounds as well (Stratil *et al.*, 2007).

Recently, natural foods and food derived antioxidants such as vitamins and phenolic phytochemicals have received growing attention, because they are known to function as chemopreventive agents against oxidative damage (Wua *et al.*, 2008). Research findings confirm that the observed health effects are due to the presence of different antioxidant molecules such as carotenoids, particularly lycopene, ascorbic acid, vitamin E and phenol compounds, particularly flavonoids (Frusciante *et al.*, 2007). Several traditional dietary plants that can decrease mineral and vitamin deficiency are also high in antioxidants (green leafy vegetables, mangoes, papaya, sweet potato, groundnuts, sesame seeds and finger millet). These have the potential to prevent malnutrition and combat infectious and chronic diseases (Stangeland *et al.*, 2009).

The plant-derived edible and non-edible products contain a wide range of phenolic compounds (such as phenolic acids, flavonoids, anthocyanins, tannins, lignans, and catechin) that possess antioxidant activities. These phenolics provide protection against harmful free-radicals and have been known to reduce the risk of certain types of cancers, coronary heart diseases, cardiovascular diseases, stroke, atherosclerosis and other degenerative diseases associated with oxidative stress (Pathirana *et al.*, 2006). There are a number of clinical studies suggesting that the antioxidants in fruits, vegetables, tea and red wine are the main factors for the observed efficacy of these foods in reducing the incidence of chronic diseases including heart disease and some cancers (Prakash, 2001).

Antioxidants present in the fruits and vegetables help to reduce the incidence of degenerative diseases such as arthritis, arteriosclerosis, cancer, heart disease, inflammation and brain dysfunction. In addition, antioxidants were reported to retard ageing besides preventing or delaying oxidative damage of lipids, proteins and nucleic acids caused by reactive oxygen species. Chemical constituents with antioxidant activity which are found in high

concentrations in plants and can be responsible for their preventive effects in various degenerative diseases, including cancer, neurological and cardiovascular diseases. Thus, the antioxidant properties of plants have a full range of perspective applications in human healthcare (Muller *et al.*, 2010).

Fruits and vegetables are a focal point, since these foods are a significant source of phenolic antioxidants, as phenolic acids and flavonoids, in the diet provide antioxidant enzymes such as superoxide dismutase, ascorbate peroxidase and guaiacol peroxidase play an important role in scavenging reactive oxygen species produced under oxidative stress, thereby protecting potential cell injury against tissue dysfunction (Sinha *et al.*, 2005). Free radicals such as superoxide, hydroxyl, peroxy, alkoxy, and non radicals such as hydrogen peroxide and hypochlorous acid scavenge radicals by inhibiting initiation and breaking of chain reaction, suppressing formation of free radicals by binding to the metal ions, reducing hydrogen peroxide, and quenching superoxide and singlet oxygen (Yan *et al.*, 2006).

Epidemiological studies consistently indicate a correlation between the consumption of fruits and vegetables (Alyson *et al.*, 2004). Flavonoid antioxidants have been studied intensively in recent years for their multiple health promoting properties. Crude extracts of herbs and spices, and other plant materials rich in phenolics are of increasing interest in the food industry because they retard oxidative degradation of lipids and thereby improve the quality and nutritional value of food (Wojdyo *et al.*, 2007). Besides flavanols and anthocyanins, in most fruits analysed, other flavonoids have been reported, such as quercetin conjugates, flavonols whose antioxidant activity is well known (Alonso *et al.*, 2004).

The peel and seed fractions possess higher antioxidant activity than the pulp fractions. For example, grape seeds had been demonstrated to be higher

than grape pulps in antioxidant capacity and were rich sources of proanthocyanidins, which were very effective in scavenging. Another example is the pomegranate peel. The antioxidant content of fruits is major and hence their associated antioxidant capacity depends first on the variety and the degree of ripening (Jimenez *et al.*, 2008).

For the most part, modern science has neglected the botanical source of knowledge and the pharmacological potential of old remedies which have not been systematically evaluated. Nevertheless many species used in traditional medicine have the potential to provide pharmacologically active natural products (Marzouk *et al.*, 2010). In longer term, plant species especially citrus fruits are identified in having high levels of antioxidant activity *in vitro* which may be of great value in designing further studies and to unravel novel treatment strategies for disorders associated with human health and diseases (Kumar *et al.*, 2008).

Tropical fruits are well known to be associated with many medicinal properties. The plant selected for the present study is *Citrullus colocynthis* Linn. (bitter apple) of *Cucurbitaceae* family. Cucurbitaceae is an important family consisting of 100 genera and 850 species, which are grown in tropical and subtropical regions of the world. Familiar species of this family are *Cucumis melo*, *Cucumis sativa* (cucumber), *Cucurbita pepo* (gourd), *Cucurbita maxima* (great pumpkin), *Cucurbita moschata* (musk pumpkin), *Citrullus vulgaris* (watermelon), *Citullus colocynthis* (bitter apple), *Luffa aegyptia* (loofah), *Momordica charanta* (coloquantida or bitter gourd) (Javed, 1994).

Citrullus colocynthis Linn (bitter apple) is a medicinal plant traditionally used to treat constipation, oedema, bacterial infections, cancer and diabetes (Kumar *et al.*, 2008). Most parts of *Citrullus colocynthis*, especially the fruits,

are used to treat numerous diseases and have been reported to have antioxidant properties (Sheded *et al.*, 2006)

The present work is done to study '**A Comparative Study On The Antioxidant Properties Of Unripe And Ripe Fruits Of *Citrullus colocynthis* (Linn.)**'

The objective of the present study was to determine

The levels of enzymic and non- enzymic antioxidants and the radical scavenging activity of the unripe and ripe fruits of *Citrullus colocynthis*.

The literature pertaining to the present study is documented in the following chapter.