ORIGINAL RESEARCH PAPER

Biological Science

ANTIOXIDATIVE PROPERTIES OF SOME CULTIVATED GREEN LEAFY VEGETABLES.

KEY WORDS:

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ABSTRACT

Antioxidants are compounds that inhibit the oxidation of other molecules and protect the body from the effects of free radicals, produced either by normal cell metabolism or as an effect of pollution and exposure to other external factors and are responsible for premature aging and play a role in many diseases. While many antioxidants are found in nature, others are obtained in synthetic form and reduce oxidative stress in organisms. Vegetables are considered an invaluable ingredient of human diet, since they diversify color of various food products and they also possess beneficial health effects due to their content in various phytochemicals such as Carotenoids, flavonoids, Phenols, Vitamins, etc, the overall high antioxidant capacity. Leaf vegetables are also called leafy greens are plants eaten as a vegetable, sometimes accompanied by tender petioles and shoots. So an investigation was made on the anti-oxidative properties of certain green leafy vegetables viz, Talinum fruticosum L , Solanum nigrum L., Alternanthera sessilis L., Moringa oleifera Lam., Amaranthus dubius, L., Coriandrum sativum. L ., Sesbania grandiflora (L.) Poir. and Trigonella foenum graecum. L.

INTRODUCTION

Antioxidant is a molecule capable of slowing or preventing the oxidation of other molecules and thereby reduces the risk of cancer and other diseases. The major action of antioxidants in cells is to prevent damage due to the action of reactive oxygen species. Studies have suggested that antioxidant supplements have benefits for health. All living organisms contain complex systems of antioxidant enzymes and chemicals, some to combat oxidative damage to cellular components and others to regulate and sustain natural cellular processes such as oxidative phosphorylation and the formation of disulfide bonds (Wang et al, 2004). All cells contain complex systems of antioxidants to prevent chemical damage to the cells components by oxidation. Antioxidants are absolutely critical for maintaining optimal cellular and systemic health and well-being. Naturally there is a dynamic balance between the number of free radicals produced in the body and antioxidants to scavenge or quench them to protect the body against deleterious effects. People consume antioxidants as a symbol of a healthy life style to fight against various health problems, better skin and anti-aging benefits (Prasad *et al.,* 2022),. The amount of antioxidant principles present under normal physiological conditions may be insufficient to neutralize free radicals generated. Therefore, it is obvious to enrich our diet with antioxidants to protect against harmful diseases. Hence there has been an increased interest in the food industry and in preventive medicine in the development of "Natural antioxidants" from plant materials. The possible toxicity of synthetic antioxidants has resulted in decreased use of these compounds in foods for human consumption. As a consequence of this and due to the appeal of natural products to consumers, numerous studies have been carried out in order to identify naturally occurring compounds which possess antioxidant activities such as phenolic photochemical (Nantz *et al,* 2006)

Vegetable means the edible part of plants, generally speaking, a plant part of which is regularly eaten as unsweetened or salted food to human is considered to be a vegetable. Green leafy vegetables are rich sources of many nutrients and their beneficial role has partly been attributed to the antioxidant components present in them of which the major portion is formed by the flavonoids, isoflavones, lignans, catechins and isocatechins (Subhasree et al., 2009; Gupta and Prakash, 2009, Nirmala and Nisansala,2017, Gioia, *et al*,2020). The importance of leafy vegetables in nutrition and health cannot be over emphasized. According to Lu and Foo (2000), a diet rich in vegetables is recommended along with fruits and whole grains since such a diet has an inverse association with the risk of chronic diseases. In recent times the medicinal value of plant source foods has assumed a more important dimension owing to the discovery that their extracts contain not only micronutrients but also a diverse array of secondary metabolites with antioxidant potential. Vegetables are known to contain antioxidants necessary in neutralizing free radicals which are known human chemical hazards (Jideani *et al*., 2021).

Phytochemical simply means plant chemicals. They are naturally occurring components in fruits, vegetables, legumes and grains. They give plants its colour, flavour, smell and are part of a plant's natural defense system. According to Liu (2004) phytochemicals are bioactive, non-nutrient plant compounds in fruits, vegetables, grains and other plant foods that have been linked to reducing the risk of major degenerative diseases. Nearly one thousand species of plants with edible leaves are known. Leafy vegetables most often come from short lived herbaceous plants. Woody plants whose leaves can also be eaten as leafy vegetables. For the present study the following green leafy vegetable viz. *Talinum fruticosum* L , *Solanum nigrum* L., *Alternanthera sessilis* L., *Moringa oleifera* Lam., *Amaranthus dudius,* L.,*Coriandrum sativum*.L., *Sesbania grandiflora* (L.) Poir. and *Trigonella foenum graecum*.L was investigated for the antioxidant properties. So, to assess the antioxidant phytochemical constitutents of some green leafy vegetables.

MATERIALS AND METHODS

The Green leafy vegetables selected for the present study are *Talinum fruticosum, Solanum nigrum, Alternanthera sessilis, Moringa oleifera, Amaranthus dubius, Coriandrum sativum, Sasbania grandiflora* and *Trigonella foenum - graecum.* All the above leafy vegetables are purchased from local market, Mayiladuthurai, Tamil nadu, India. Similarly, all the chemicals used in the present study were analytical grade and purchased from Spectrochem. The leaves and young shoots were excised and washed thoroughly to remove any soil debris and dust, and to dry in shade and dried in oven at 60^{0}C for 2 days until constant weight obtain. Dried materials were powdered in a mixer grinder and stored in Air tight containers for further use. Two grams of each powdered samples were extracted with 20ml of 80 % Ethanol. The

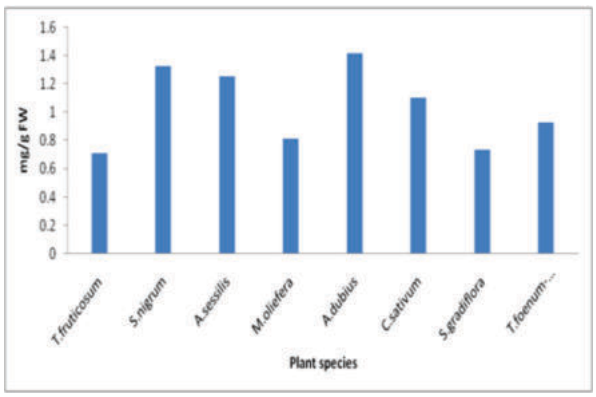
extracts were filtered through whatman No. 1 filter paper & stored in air fight glass vials. The phytochemicals such as chlorophyll (Arnon, 1949), Carotenoids (Kirk and Allen, 1965), Total phenolic content (Malick and Singh, 1980), Tannin (Schanderl, 1970), Vitamin C (Prieto *et al*. 1999) and Vitamin E (Oyaizu, 1986) was measured in all the leafy vegetables.

RESULTS AND DISCUSSION

Consuming foods rich in antioxidants may help to prevent or slow the oxidative stress induced by free radicals. Since there is still much to understand about phytochemicals, interest is moving towards assessing the antioxidant activity and *in vivo* effects of whole foods. The *in vivo* evidence that fruit and vegetables actually reduce markers of oxidative damage has been limited. Null findings may be influenced by many factors including absorption and metabolism of phytochemicals, study length and design, and individual variation in antioxidant status and responsiveness to dietary antioxidants. Nevertheless, studies have shown that eating fruit and/or vegetables can reduce the amount of damage free radicals cause to the blood (Addai et al., 2013). Phytochemicals and antioxidant constituents in plant material have raised interest among scientists, food manufacturers, producers, and consumers for their roles in the maintenance of human health. Numerous epidemiological studies suggest that diets rich in phytochemicals and antioxidants execute a protective role in health and disease. Frequent consumption of fruits and vegetables is associated with a lowered risk of cancer, heart disease, hypertension and stroke (Balamurugan *et al*., 2013).

Carotenoid

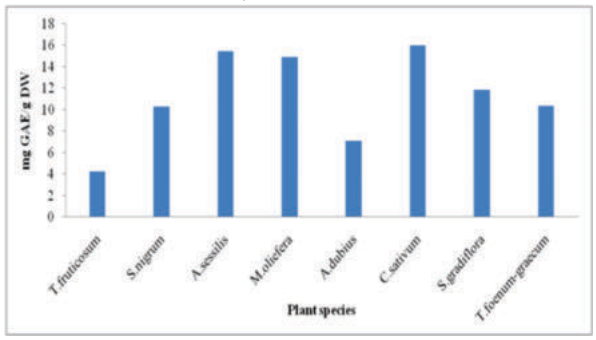
Carotenoid exhibits a central role against cancers, cardiovascular diseases and HIV infection and other age-related disorders. The anti- cancer role of carotenoids may be singlet oxygen (Mascio *et al.,* 1991 and Steinmetz and Potter., 1991). Carotenoids consist of a group of lipophilic pigmented compounds that is made up of over six hundred fat-soluble plant pigments. They are chiefly responsible for colors such as yellow, red, and orange present in FAV and from which the compounds are derived. Major carotenoids present in human diets are α-, β-carotene, lutein, lycopene, zeaxanthin, astaxanthin, and β-cryptoxanthin, with these compounds playing an active role in the protection of plants from the damaging and scourging effects of exposure to sunlight. (Krinsky and Johnson., 2005). The ethanolic extract of *Amaranthus dubius* have higher (1.416) carotenoid content followed by *Solanum nigrum* (1.328). Similarly, the least amount of carotenoid content was recorded in *Talinum fruticosum* (0.720) (Fig-1).



Total phenolic content

Phytochemicals such as flavonoids, phenols and anthocyanins have been of great interest as the source of natural antioxidant. Numerous natural antioxidants have been isolated from different varieties of plant materials such as leafy vegetables, fruits, seeds, cereals and algae (Ragupathi raja kannan, 2012, Hua *et al,* 2015). The ethanol extracts of *Coriandrum sativum* showed highest total phenolic content and it was 1.805 mg/g calculated as Gallic acid equivalent phenols was detected. Which was of a similar magnitude to 11.5 and 12.5 mg GAE/g dw reported by Gupta and Prakash (2009). The total phenol content of ethanol extracts exhibited the following order: *Coriandrum sativum >Alternanthera sessilis> Moringa oleifera >Sasbenia grandiflora > Trigonella foenum graecum > Solanum nigram> Amaranthus dubius> Talinum fruitcosum.* Phenolic compounds undertake antioxidant, pro-oxidant, anti-inflammatory activities and also exert great influence on the bioavailability of nitric oxide in humans (Bruno et al., 2006). (Fig-2)

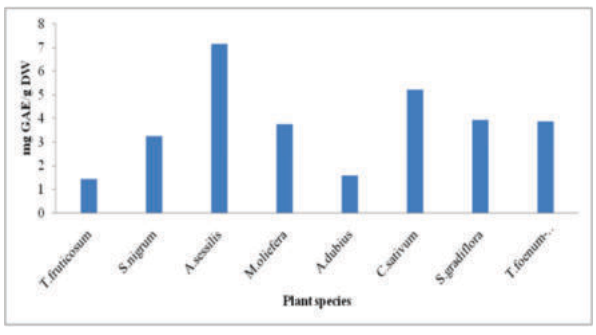
Many plant extracts have been reported to have multiple biological effects, including antioxidant properties due to their phyto constituents. The antioxidant activity of phenolics is mainly due to their redox properties, which can play an important role in adsorbing and neutralizing free radicals (Shah *et al* 2010, Prasad *et al*., 2022). It is well known that plant phenolics function as highly effective free radical scavengers and antioxidants (Kagla and Sabale, 2013). Phenols are known to possess a wide range of therapeutic uses, such as antioxidant, antimutagenic, antitumor activities (Othman *et al* 2007, Rahaman *et al*, 2022).



Tannin

Tannins are a group of water-soluble polyphenols of intermediate to high molecular weight. Tannins are highly hydroxylated molecules and can form insoluble complexes with carbohydrates, proteins and digestive enzymes, thereby reducing food digestibility. They can also bind cellulose and many mineral elements (Bravo., 1998, Jideani et al, 2021).

The Results of the study shows that *Alternanthera sessilis* contains higher tannin contents when compared with all the other Green leafy vegetables tested. The tannin content of *Alternanthera sessilis* have 7.16 mg/g calculated as Tannic acid equivalent tannin was detected. The total tannin content of ethanolic extracts exhibited the following order. *Alternanthera sessilis> Coriandrum sativum Sasbenia grandiflora > Trigonella foenum -graecum> Moringa oleifera> Solanum nigrum> Amaranthus dubius> Talinum fruticosum* (Fig-3).

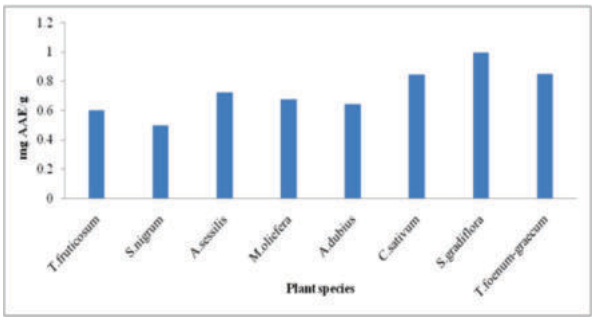


Vitamin - E

Vitamin -E consists of four tocopherals and corresponding tocotrienols which contain unsaturated side chains. Most plant derived foods, especially fruits and vegetables, contain Low to moderate levels of vitamin -E activity (Sagar *et al*, 2018). Consisting of eight different types: α-, β-, γ- and δ-

tocopherols and the □-, □-, □- and □ tocotrienols, vitamin E can be obtained from vegetable oils, nuts, and seeds of different fruits.(Li,2011) Experimental model studies in vitro and in vivo have shown the antioxidative, pro-antioxidative, anti-inflammatory, modulation of cell signaling, antiproliferation, antiangiogenesis, and apoptosis induction effects of vitamin E. Other works have also shown that □-tocopherol is the major form in human tissues.

Results of the study shown that the ethanolic extract of *Talinum fruticosum* (3.275) contain higher vitamin -E content followed by *Coriandrum sativum* (2.899). Similarly, lower vitamin -E content was recorded in *Amaranthus dubius,* (1.234) when compared with all the other plants tested (Fig-4). The total tocopherol content ranges from 121 mg/kg in grape seed oil to 829 mg/kg in corn and soybean oil (Gliszczynska-Swiglo, 2007). Vitamin -E the lipid soluble chain breaking antioxidant scavenges free radicals and prevents lipid peroxidation, thus stabilizing the cell membrane.



Vitamin -C

Vitamin -C is considered an excellent antioxidant because it donates electrons for enzymes or other compounds that are oxidants. Bruno *et al* (2013) stated that the roles of vitamin C include the regulation of cell growth, cell signaling, apoptosis, antioxidants, and as cofactors for enzymes. Vitamin C occurs mainly in fruits and vegetables and it is reduced by heat during processing; hence, its nutrient density in raw fruits and vegetables is higher than in processed forms. The extracts of *Sasbania grandiflora* showed highest vitamin- C content and it was 0.99 mg/g calculated as Ascorbic acid equivalent vitamin -C was detected. The vitamin -C content of ethanol extracts exhibited, *Sasbenia grandiflora* > *Trigonella foenum graecum Coriandrum sativum* > *Alternanthera sessilis* > *Moringa oleifera*> *Amaranthus dubius*> *Talinum fruticosum* > *Solanum nigrum* (Fig-5).

CONCLUSION

It is thus to be concluded; the green leafy vegetables have an enormous scope as a natural antioxidant source. Their tremendous potential as dietary therapeutic agents needs extensive documentation. The green leafy vegetables possess higher potential to cope against oxidative stress and thus act as strong anti-cancerous as well antidegenerative foods. This work will also be a prelude to replenish our ancestral knowledge about these underutilized vegetables that will be helpful for the betterment of upcoming generations. Further research works to be carried out on isolation and characterization of valuable phytochemicals and their antioxidant potentials.

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