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ENZYMATIC ANTIOXIDANT OF *FICUS CARICA, EMBLICA OFFICINALIS, CEPHALANDRA INDICA* AND *TERMINALIA CHEBULA*

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ABSTRACT

Antioxidants are compounds that protect cells against the damaging effects of reactive oxygen species, such as singlet oxygen, superoxide, peroxyl radicals, hydroxyl radicals and peroxynitrite. An imbalance between antioxidants and reactive oxygen species results in oxidative stress, leading to cellular damage. Oxidative stress has been linked to cancer, aging, atherosclerosis, ischemic injury, inflammation and neurodegenerative diseases. The enzymatic antioxidants like catalase, peroxidase, superoxide dismutase, polyphenol oxidase, glutathione - S transferase, glutathione peroxidase and glutathione reductase were studied in the selected fruits like *Ficus Carica, Emblica officinalis, Cephalandra indica* and *Terminalia chebula. E. officinalis* was found to be rich in enzymic antioxidant such as catalase, peroxidase superoxide dismutase, polyphenol oxidase, glutathione - S transferase, glutathione peroxidase and glutathione reductase

KEYWORDS

Antioxidant, *F.carica, E.officinalis, C.indica, T.chebula.*

INTRODUCTION

Medicinal plants owe its importance to the presence of various complex substances of different composition, which are found as secondary plant metabolites, according to their composition, are grouped as alkaloids, glycosides, corticosteroids and essential oils[1]. Drugs of plant origin play an important role in medicine. Research on bioactive substances from plant source has great scope and could lead to the provision of value added economic return. In recent years, the plants are gaining importance as strong antimicrobial agents. Medicinal plants have become the focus of intensive study recently in terms of conservation and as to whether their traditional uses are supported by actual pharmacological effects or are merely based on folklore[2]. The present study was to observe enzymatic antioxidant activity of *F. carica, E. officinalis, C. indica* and *T. chebula*.

MATERIALS AND METHODS

The enzymatic antioxidants like catalase[3], peroxidase [4], superoxide dismutase[5] polyphenol oxidase[6], glutathione – S tranferase[7], glutathione peroxidase[8]and glutathione reductase [9] were studied in the selected fruits.

RESULTS

Antioxidants are important naturally occurring nutrients that help to maintain health. Antioxidants are found in certain foods that neutralize free radicals. These include vitamin A, C and E and the minerals copper, zinc and selenium. Other compounds such as the phytochemicals in plants and zoo chemicals from animal products are believed to have greater antioxidant effects than either vitamins or minerals. Antioxidants are either nutrients or enzymes which mopup damaging free radicals in our bodies.

The levels of various antioxidative enzymes were determined and presented in Table 1 and 2. Table 1 reveals the activity of catalase, superoxide dismutase, peroxidase and polyphenol oxidase in the plant samples.

Table 1.
The levels of various antioxidant enzymes

S. No	Plant screened	Catalase units @/g	Peroxidase units $/g	Superoxide dismutase units #/g	Polyphenol oxidase 10^{-3} units */g
01	*F. carica*	1566.667	4.253	0.073	2.293×10^{-3}
02	*E. officinalis*	3533.333	9.247	2.710	6.900×10^{-3}
03	*C. indica*	1533.333	6.247	1.180	1.403×10^{-3}
04	*T. chebula*	2466.667	5.617	0.760	4.563×10^{-3}
SED		124.7219	0.1048	0.0364	0.0002
CD (0.05)		287.6125	0.2417	0.0839	0.0004

The values are mean of triplicate.
@/unit – Amount of enzyme required to decrease the optical density by 0.5 units at 240 nm.
$/unit – Change of absorbance / minute at 430 nm.
***/unit – Amount of catechol oxidase / laccase which transforms 1µ mole of dihydric phenol to quinone / minute.**
#/unit – Amount of enzyme that gives 50% reduction in nitroblue tetrazolium.

Table 2.
Levels of enzymatic antioxidants in the plant samples

S. No	Plant screened	Glutathione-S-transferase units x/g	Glutathione peroxidase units b/g	Glutathione reductase units a/g
01	*F. carica*	0.331	0.424	0.002
02	*E. officinalis*	1.269	0.987	0.129
03	*C. indica*	0.627	0.629	0.017
04	*T. chebula*	0.939	0.847	0.057
	SED	0.0017	0.0027	0.0011
	CD (0.05)	0.0040	0.0063	0.0025

The values are mean of triplicates.
x/unit - µmoles of CDNB conjugated / minute.
a/unit - µmoles of NADPH utilized.
b/unit - µmoles of GSH utilized / minute.

In the present study, the estimated catalase level in different plant extracts ranged widely from 3533.333 + 1533.333 units/g. The maximum catalase activity was exhibited by the fruit extract of *E. officinalis* (3533.333 units/g). The lowest value was observed in the extract of *C. indica* (1533.333 units/g). Fruit extract of *E. officinalis* exhibited the highest activity of super oxide dismutase (2.710 units/g). The minimum activity was showed by the extract of *F. carica* (0.073 units/g).

The fruit extract of *E. officinalis* showed the highest peroxidase activity (9.247 units/g) compared to other fruit extracts. Very low activity of peroxidase was observed in the extract of *F. carica* (4.253 units/g).

The minimum polyphenol oxidase activity was shown by the fruit extract of *C. indica* (1.403 x 10^{-3} units/g). The maximum results were shown by the extract of *E. officinalis* (6.900 x 10^{-3} units/g). The fruit extracts of *F. carica* and *T. chebula* showed 2.293 x 10^{-3} units/g and 4.563 x 10^{-3} units/g, respectively.

Table 2 represent the activity of the Glutathione-S-transferase, Glutathione peroxidase and Glutathione reductase in the extracts of *F. carica, E. officinalis, C. indica* and *T. chebula*. The increased activity of Glutathione-S-transferase, glutathione peroxidase and maximum Glutathione reductase was found in the extract of *E. officinalis* (1.269 units/g, 0.987 units/g and 0.129 units/g). The extract of *F. carica* exhibited very poor enzymatic antioxidants. The presence of all the three enzymatic antioxidant was found to be minimum in the extract of *C. indica*.

DISCUSSION

Superoxide dismutase (SOD) and catalase (CAT) play an important role in the detoxification of superoxide anion and H_2O_2 respectively, thereby protecting the cells against oxidative free radicals (OFRs) induced damage[10]. Studies on antioxidant enzymes revealed that the *Hyptis suaveolens* extracts treated animals showed significant increase in the levels of superoxide dismutase and catalase, the two powerful antioxidant enzymes of the body that are known to quench superoxide radicals[11].

The levels of various enzymic and non-enzymic antioxidants in selected berries and revealed that the berries possess predominant quantities of enzymatic antioxidants namely SOD, catalase and polyphenol oxidase[12]. The increased level of enzymatic antioxidants Glutathione peroxidase and Glutathione-S-transferase in root and leaf segments of *Phalaenopsis* led to the breakdown of oxidants such as H_2O_2, organic hydro

peroxides and lipid hydro peroxides resulting in greater protection against oxidative damage[13].

The considerable increase in the activities of antioxidant enzymes (SOD, CAT, GPx and GST) and improvement in hepatic GSH status in *Indigofera tinctoria* pre treated rats clearly indicate the protection offered by pretreatment with plant extract and thereby suggests an antioxidant effect [14].

The antioxidant activity of carotenoids (β-carotene, lycopene, paprika, marigold, bixin- and norbixin-rich annatto extracts) was estimated in sunflower oil-in-water emulsions (o/w) stabilized either by Tween 20 or by a mixture of Tween 20 and sodium caseinate at equal concentrations. Both polar (paprika, marigold, bixin, norbixin) and hydrophobic (β-carotene, lycopene) carotenoids exerted a clear antioxidant effect during thermal accelerated autoxidation (60 °C) of o/w emulsions stabilized by Tween 20, while in the protein-based emulsions only polar carotenoids acted as antioxidants against the production of primary and secondary oxidation products. Furthermore, o/w emulsions, containing different concentration of paprika and bixin-rich annatto extract (0.25–1.5 g/L) in the lipid phase oxidized slower than the control emulsions. Meanwhile, the rate of carotenoids' degradation revealed that polar carotenoids, which presented antioxidant effect in both protein and Tween 20 stabilized emulsions, presented a higher rate of degradation than the hydrophobic carotenoids.[15]

CONCLUSION

Evidence suggests that a diet high in fruits and vegetables may decrease the risk of chronic diseases, such as cardiovascular disease and cancer, and phytochemicals including phenolics, flavonoids and carotenoids from fruits and vegetables may play a key role in reducing chronic disease risk. Apples are a widely consumed, rich source of phytochemicals, and epidemiological studies have linked the consumption of apples with reduced risk of some cancers, cardiovascular disease, asthma, and diabetes. In the laboratory, apples have been found to have very strong antioxidant activity, inhibit cancer cell proliferation, decrease lipid oxidation, and lower cholesterol. *E. officinalis* was found to be rich in enzymic antioxidants such as catalase, peroxidase, superoxide dismutase, polyphenol oxidase, glutathione-S-transferase, glutathione peroxidase and glutathione reductase.

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