EVALUATING THE PROTECTIVE ROLE OF SOME ANTIOXIDANTS AGAINST THE INDUCED FREE RADICALS RESULTING FROM DIFFERENT ENVIRONMENTAL POLLUTANTS

Submitted By

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B.Sc. of Agricultural Science(General), Faculty of Agriculture, Cairo University, 1985

Diploma of Environmental Sciences, Institute of Environmental Studies & Research, Ain Shams University, 1998

M. Sc. of Environmental Science, Institute of Environmental Studies & Research, Ain Shams University, 2007

A thesis submitted in Partial Fulfillment
Of
The Requirement for the Doctor of Philosophy Degree
In
Environmental Science

Department of Environmental Agricultural Science
Institute of Environmental Studies and Research
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APPROVAL SHEET

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ABSTRACT

Eman Goma Mohammed Kelany

Evaluating the Protective Role of some Antioxidants against the Induced Free Radicals Resulting From Different Environmental Pollutants

PhD Thesis, Agric. Sci. Dept.,
Institute of Environmental Studies and Research,
Ain Shams University (2014).

This study was designed to investigate the antioxidant activity of 39 substances namely synthetic and natural raw materials used in pharmaceutical preparations and as a food, using different model systems in order to find out new potential sources of natural antioxidants, also comparison study between synthetic and natural compound under investigation. The results showed that all compounds dose-dependently scavenge DPPH free radical. Catechin has the highest free radical by 98.8%, whereas p-cresol has the lowest scavenging activity on DPPH radical by 10.7% at 160 µg/ml. Also, all samples under investigation have inhibitory effect against hydroxyl radical mediated DNA damage and this inhibitory effect is dose-dependent manner. Catechin (97.5%) had the highest scavenging value on hydroxyl radical mediated DNA-damage, whereas 4-hydroxybenzalehyde had the lowest scavenging effect (9.15%). Also, quercetin exerted the highest inhibition effect by 97.3% at 160 µg/ml against lipid peroxidation in mitochondria induced by ferrous/ascorbate model system. Morever qurecetin and rutin had the highest inhibitory effect against lipid peroxidation in lysosomes induced by ferrous/ascorbate mode system. Furthermore, rutin and catechin had the highest inhibitory effect against microsomes lipid peroxidation-induced by ferrous/ascorbate model system, whereas resorcinol exerted the lowest inhibitory effect against microsomes lipid peroxidation. The best five compounds (ascorbic acid, quercetin, caffeic acid, catechin and rutin) by four concentrations; 60, 120, 240 and 480 µg/ml appeared to protect the lysosomal membrane against cisplatin. Ascorbic acid, catechin, caffeic acid and quercetin showed the highest inhibitory effect against cisplatin. The results of this study stated that the five compounds could be taken with cisplatin to reduce its nephrotoxicity.

Key words: antioxidant activity, antioxidant compounds, DPPH free radical, lipid peroxidation, lysosomal membrane, cisplatin.

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1-INTRODUCTION

Humans are continuously exposed to different kinds of chemicals such as food additives, industrial chemicals, pesticides and other undesirable contaminants in the air, food and soil **(Stavric, 1994).** Most of these chemicals induce a free radical-mediated lipid peroxidation leading to disruption of bio-membranes and dysfunction of cells and tissues (**Cho *et al*., 2003).** Synthetic or natural antioxidants play a significant role in protecting living organisms from the toxic effect of various chemicals by preventing free radical formation **(Sheweitaet al., 2001).**

On the other hand, reports revealing that synthetic antioxidants could be toxic, with regard to food additives or pharmaceutical products safety, identifying alternative natural and probably safer source of food antioxidant is needed.

Free radicals originating from cellular metabolism primarily in the mitochondriacan act directly on liver tissues, In addition attack critical target molecules or attack polyunsaturated fatty acid in membranes and initiate lipid peroxidation and liver cirrhosis (**Irmak et al, 2002).**

Free radicals are defined as molecules having an unpaired electron in the outer orbit. They are generally unstable and very reactive. There is a lot of evidence revealing the role of reactive oxygen species (ROS) in several diseases. ROS are generated as byproducts of cellular metabolism, primarily in the mitochondria **(Szocs, 2004).**These ROS are scavenged by antioxidant enzymes namely superoxide dismutase (SOD), glutathione peroxidase(GSH-Px) and catalase (CAT). Under some circumstances, these endogenous antoxidative defenses are likely to be perturbed as a result of overproduction of oxygen radicals, inactivation of detoxification

systems, and failure to replenish antioxidants in tissues adequately (**Irmak et al., 2002).**

This study was designed to investigate the antioxidant activity of some compounds using different model systems in order to find out new potential sources of natural antioxidants also, comparison study between synthetic and natural compound under investigation

Recently special attention is focused on the substation of synthetic antioxidants used in foods and pharmaceutical preparations by natural ones. Therefore, the present study was designed to compare the antioxidant activityof synthetic sources used as food additives and in the pharmaceutical preparations with the natural ones. To achieve this aim, the following topicswere considered;

PART 1

-1,1-diphenyl-2-picrylhydrazyl ($DPPH^{\cdot}$) scavenging activity system

PART 2

-Deoxyribonucleic acid (DNA) damage system and-deoxyribose sugar degradation system

PART 3

-Ferrous/ascorbate model system which produced hydroxyl radical and induced lipid peroxidation inliver mitochondria, microsomes and lysosomes.

PART 4

-Effect of ascorbic acid, quercetin, caffeic acid, catechin and rutin on cisplatin-induedlysosomalmembrane damage.