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An Overview of Free Radicals & Antioxidants and its Deletenous Actions

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Abstract

In modern years, there has been a large dealing of work toward the area of free radical chemistry. Free radicals reactive oxygen species and reactive nitrogen species are create by our body by various endogenic systems, influence to different physio chemical conditions or unhealthy states. A balance between free radicals and antioxidants is necessary for proper physiological function. If free radicals overwhelm the body's ability to modulate them, a condition known as oxidative stress ensues. Free radicals thus unfavorable alter lipids, proteins, and DNA and activate a number of human diseases. Hence application of external source of antioxidants can assist in coping this oxidative stress. Synthetic antioxidants such as butylated hydroxytoluene and butylated hydroxyanisole have recently been reported to be dangerous for human health. The present review provides a brief overview on oxidative stress mediate cellular damages and role of dietary antioxidants as functional foods in the organization of human diseases. We need to take balance diet which provide much more antioxidants to lower risks of health and run to life longer.The purpose of this review is that we want awareness related to sources of antioxidants from plants and highlight the studies of antioxidants and free radicals which provide prove for maintaining healthy aging.

Key words: antioxidant, free radicals, aging, oxidative stress.

I. Introduction

Free radicals can damage the cell and DNA and produce the oxidation of macromolecules. Natural antioxidants can also produce in our body which neutralize the free radical damaging ability. Environmental toxins, radiations, smoking produce free radicals. The antioxidants can also be taken from exogenous sources. Free radicals induce many degenerative and chronic diseases. Antioxidants are obtained from plants i.e fruits, cereals, flowers, vegetables and beverages. Natural antioxidants are vitamins, carotenoids and polyphenols. These antioxidants can act as anti-viral, anti-inflammatory, anti-bacterial anti-cancer and anti-aging. Many extraction methods used for antioxidants. Non-conventional methods used to improve the extraction efficiency of antioxidants from plant material (Acworth, McCabe, & Maher, 2017)

1.1 Free Radicals

"Free radical is an atom or molecule that consist one or more electrons in most outer shell and it is stable to exist independently (Acworth et al., 2017). Oxidative stress is caused by free radicals, Reactive Oxygen Species (ROS) which damage DNA, bio-membrane lipids, proteins and other super-molecule. ROS can be categorized into oxygen centered radicals and oxygen centered non radicals. The oxygen centered radicals are superoxide anion ($O^{\bullet -2}$), hydroxyl radicals ($OH^{\bullet}$) and alkoxyl radicals ($RO^{\bullet}$) and peroxyl radicals ($ROO^{\bullet}$)(Acworth et al., 2017).Oxygen centered non radicals are hydrogen peroxide (H_2O_2) and singlet oxygen ($1\backslash 2O_2$). Other radicals species are nitrogen species such as nitric oxide ($NO^{\bullet}$), nitric dioxide ($NO^{\bullet}{}_2$) and peroxynitrite ($OONO^{-}$).The first source of ROS is leakage of electron from the respiratory chain during the step-down of molecular oxygen to water produce superoxide anion. ROS can be clean by the use of antioxidant system including non-enzymatic components and an order of antioxidant enzymes (Acworth et al., 2017). Non enzymatic components include glutathione, selenium, vitamin C and E. The antioxidant enzymes add glutathione peroxidase, catalase and superoxide

dismutase which are the most major antioxidant enzymes that are capable to minimize oxidative stress in the organelles (Halliwell & Gutteridge, 2015).

1.2 Background

In these years, the interest is increasing to study the role of free radicals. In biology field because it has various role in many physiological processes and diseases. Professor Gomberg, Professor of chemistry at the university of Michigan Visualize first time the presence of organic free radical triphenyl methyl radical in the living organism in 1900 (Halliwell & Gutteridge, 2015). "Free radical theory of toxicity" which stated that the quality to give toxic effects by oxygen is due to its ability to form oxygen (Halliwell & Gutteridge, 2015). By the Commoner, et al in the same year electron para magnetic resonance (EPR) has proved the existence of free radicals in biological system (Halliwell & Gutteridge, 2015).Very soon in 1956 the "free radicals theory of aging" proposed by the Denham Harman. In 1969, the opposite to superoxide anion as its defense system the superoxide dis-mutase enzyme (Mayorga Burrezo et al., 2019). Very first time it was introduced that these reactive oxygen species are also produced in cellular metabolic processes (Mayorga Burrezo et al., 2019). They noticed that the production of second messenger cyclic GMP by the activation process of guanylate cyclase produces by the hydroxyl radical (OH) (Mayorga Burrezo et al., 2019). Reactive oxygen species contain both free radicals and derivatives of oxygen non radical observed by the Halliwell and Gutteridge in 1989. Since from that data on free radicals has been published on large scale (Mayorga Burrezo et al., 2019).

1.3 Classification of antioxidants

They are classified in two groups mainly that are:

- Natural antioxidants
- Synthetic antioxidant

1.3.1 Natural antioxidants

These antioxidants are occur naturally and consist of the low or high molecular weight antioxidants that are different in many factors such as physical and chemical properties, place of action, composition and their functions (Pan, Li, Lang, & Xing, 2019).

They can be further subdivided into different types.

- Enzymes
- Low molecular weight antioxidants
- Lipids soluble antioxidants
- Water soluble antioxidants

1.3.1.1 Enzymes

These include the different enzymes like glutathione peroxidase, catalase and superoxide dismutase. These enzymes are the production of the species of reactive oxygen that are produced by the potential of the oxidants. In late 60s, Superoxide dismutase was introduced (Vadgama, 2021). It has a function to convert its radical into the hydrogen peroxide. This hydrogen peroxide is then broken into oxygen and water by the other enzyme known as catalase. The reduction of the lipid peroxides into harmless molecule is carried out by the glutathione peroxidase enzyme (Pan et al., 2019).

1.3.1.2 Low molecular weight antioxidants

These antioxidants further divided into two different types that are lipid soluble antioxidant and the water soluble antioxidants. These stop the damage of cells that is due to the free radicals.

1.3.1.3 Lipids soluble antioxidants

These antioxidants may contain bilirubin, polyphenols, quinones, tocopherol and carotenoids. The accumulation of these antioxidants is highly abundant in the lipoproteins of the lipid plasma. They are mostly effective to the radical of the lipid Peroxyl that are produced by the chain reaction of the free radicals of the peroxidation of lipids in the lipoproteins (Pan et al., 2019).

1.3.1.4 Water soluble antioxidants

These antioxidants may contain the polyphenols, Vitamin C and uric acid. These are soluble in water so these are less effective to lipoproteins of the low density. The regeneration of them is done by these antioxidants with the lipophilic antioxidants (Vadgama, 2021).

1.3.2 Synthetic antioxidant

These antioxidants are not produced naturally. By drug and food administration, these are approved. These are highly efficient and these contain the chemicals that are synthetic (Vadgama, 2021).

2. Free Radical's Mode of Action

Free radicals are produced by three different processes.

- Oxygen atom has two parallel whirl electrons in its out-most orbital.
- Weak bond break and free radical produce.
- Covalent bond break and produce free radicals by homolytic and heterolytic fission.
- Radicals produce by thermolysis and photolysis process.
- Once free radicals generate, they formed a chain reaction with initiation, termination and propagation (Vadgama, 2021).

In the mechanism of the formation of free radicals, one radical may take electrons from the other molecules to get pair and also donate their unpaired electron to other molecules. When these radicals get or lose one electron then become a radical. When one radical begets another then leads to further processes such as chain reaction (Peña-Bautista, Baquero, Vento, & Cháfer-Pericás, 2019).

2.1 Molecular target of Free Radicals

Nitrosative and antioxidant stresses are produced by imbalance between the production of free radicals and defenses of antioxidants. Free radicals damage the important biological molecules such as Proteins, Lipids and Nucleic acid due o their high reactivity (Peña-Bautista et al., 2019).

2.1.1 Ribonucleic acid (RNA)

Different RNAs produced in our body may damage by the ROS free radicals.RNA is more susceptible of this damage because of its single strand nature as compared to DNA.RNAs are more effective by ROS radicals because they don't have the repair mechanism and they are located near the mitochondria where these radicals are produced (Peña-Bautista et al., 2019). The most effective product of RNA studied is 7, 8-dihydro-8-oxo-guanosine. Its level is higher in some conditions such as Parkinson's disease, Alzheimer disease, atherosclerosis and myopathies (Peña-Bautista et al., 2019).

2.1.2 Lipids

Most prone lipids that are damaged by free radicals are membrane lipids that are polyunsaturated fatty acid residue of phospholipids. Oxidative degradation of lipids is caused by the free radicals may lead to the loss of fluidity and mechanism of cell membrane. This oxidative degradation of lipids may cause damage to the DNA and proteins (Peña-Bautista et al., 2019).

2.2 Free radical Properties

Free radicals are the main products which produce in the aerobic organisms cells, they can start the auto-catalytic reactions by changed into free radicals to move in the process of destruction (Sharma, Gupta, & Sharma, 2018). These species can be induce by

- X-rays and gamma rays
- UV light irrigation
- Exist in environment as poison
- Production of neutrophils and macrophage
- Product of electron transport chain reactions

2.3 Types of free radical

There are two forms of free radicals that are: (Sharma et al., 2018)

2.3.1 ROS (Reactive Oxygen Species)

- Oxygen centered radicals
- Oxygen centered non radicals

2.3.2 RNS (Reactive Nitrogen Species)

Superoxide anions, hydroxyl radicals, peroxyl radicals and alkoxyl radicals are oxygen centered radicals while hydrogen peroxide and singlet oxygen are oxygen centered non radicals (Shen et al., 2017).

2.3.3 Hydroxyl Radical

It is hydroxide ion which is present in neutral form with high sensitivity (Shen et al., 2017). It may react with the other molecules such as DNA, Proteins, Nucleic acid, Lipids and Carbohydrates and effect many cells (Sharma et al., 2018). It can be produced by a reaction in which H_2O_2 and a ferric (Fe^{+2}) or a Cupperic (Cu+) ions both react each other to form Hydroxyl radical. This reaction is known as Fenton Reaction (Sharma et al., 2018). It is also produced by another reaction in which both superoxide and H_2O_2 reacts to form the Hydroxyl radical. This reaction is known as Haber Weiss Reaction (Shen et al., 2017).

2.3.4 Ozone

It is very strong oxidant that is formed in living organisms by the antibody. It may act as an oxidizing molecule to produce the free radicals. It may cause the swelling and chromosomal disorders (X.-Q. Wang, Wang, Peng, & Zhang, 2020).

2.3.5 Nitric Oxide or Nitrogen Monoxide

Nitric Oxide Synthases converts L-arginine to L-citrulline to produce a very small free radical Nitric Oxide in the tissues. Three isoforms of Nitric Oxide i.e. Neuronal, Inducible and Endothelial NOS undergoes oxidation to produce this free radical (X.-Q. Wang et al., 2020).

These free radicals can easily pass out into cytoplasm and plasma membrane because these are water and lipid soluble in nature. It is act as an intracellular second messenger to help in the muscle relaxation in the blood veins. It has an important role in many biological functions such as relaxation of smooth muscles, protective mechanism and regulation of blood pressure and immune system and neurotransmission (X.-Q. Wang et al., 2020).

Table 1: Free radicals

Free radical	Name	Symbol
Oxygen radical	Oxygen	$O_2^{\cdot}$
-	Superoxide ion	$O_2^{\cdot}$
-	Hydroxyl	$OH^{\cdot}$
-	Peroxyl	$ROO^{\cdot}$
-	Alkoxyl	$RO^{\cdot}$
-	Nitric oxide	$NO^{\cdot}$
Non-reactive oxygen radical	Hydrogen peroxide	H_2O_2
-	Organic peroxide	ROOH
-	Hypochlorous acid	HOCL

3. Free Radical Sources & Effects

3.1 Free Radical Sources

Free radicals can be produce by exogenic and endogenic sources. Cellular organs are the endogenic sources alike peroxisomes, mitochondria and endoplasmic reticulum. where the utilization of oxygen is at top level (Wu, 2020).

3.1.1 Mitochondria

Majority of free radicals obtain by intracellular processes from mitochondria. There two important sites in the electron transport chain

- ✧ Complex I(NADH dehydrogenase)
- ✧ Complex III(ubiquinone cytochrome c reductase)

Superoxide radicals are obtained at these two sites.

Electrons shifts from one complex I or II to co-enzyme Q and produced the reduced form of co-enzyme Q (QH2).In the Q-cycle semiquinone anion an unstable intermediate used to re produce the co enzyme Q by reduced form QH2 (Wu, 2020).

Superoxide radicals produced immediately by transfer of electrons from co enzyme Q to molecular oxygen. This process is a non-enzymatic process. Superoxide radical production have high metabolic rate and production of free radical (Satta et al., 2017). Mitochondrial enzyme superoxide dis mutase play the role to produce hydrogen peroxide by converting superoxide anion. The toxic effect of hydrogen peroxide is destroy by catalase and glutathione peroxidase. Mono amino oxidase, alpha ketoglutarate dehydrogenase, glycerol phosphate dehydrogenase and p66shc are the important components of mitochondria for the production of ROS (Wu, 2020).

3.1.2 Endoplasmic Reticulum

Cytochrome b5 and p-450 are the ER enzymes involving in the production of Reactive Oxygen Species (Wu, 2020). Thiol Oxidase is most important enzyme that transfers the electrons from dithiol to the oxygen which leads to the production of the H_2O_2 (Satta et al., 2017). There are some other sources such as FADH2, Cytochrome p-450; phagocytic cells, FMNH2, mental stress, aging, cancer, immune cells activation, inflammation and excessive exercise are involved in the production of the ROS (Żukowski, Maciejczyk, & Waszkiel, 2018).

3.2 Free radical Effects

As free radicals produce in our body, they generate many diseases. There are many pathological problems.

- Cardiovascular diseases
- Neurodegenerative diseases
- Asthma
- Diabetes mellitus
- Cancer
- Cataracts etc

Table 2: Free Radicals and their effects

Sr.no	Free Radicals	Cellular Sources	Effects in Human Body	References
1.	Reactive Oxygen Species	Fibroblasts, NADPH oxidase, Respiratory reactions, Inflammatory cells, Endothelial cells	Diabetes Mellitus (Diabetic ketoacidosis, Hyperglycemic), Retinopathy, Neuropathy, Atherosclerosis, Cerebrovascular disease, Renal disease, Asthma, Chronic bronchitis,	Alkadi, 2020; Ambad, 2020; He, 2017; Żukowski et al., 2018
2.	Reactive Nitrogen Species	Peroxisome reactions, inflammatory reactions, Fibroblasts	Cardiovascular, Renal disease, gastro vascular disease, Neuropathy, Retinopathy	Sevcsik et al., 2011; Gupta et al., 2020; Moein et al., 2017.
3.	Hydroxyl Radical	Oxidase reaction	Diabetic, Asthma Aging, Bronchitis	Moein et al., 2017, Sundaram Sanjay & Shukla, 2021

3.2.1 Diabetes Mellitus

Diabetes mellitus is caused by increase the glucose level in blood is called hyperglycemia condition. It can be due to

- By defective insulin secretion
- By resistance to insulin function
- Or both

Diabetes mellitus is also lead by increasing the formation of free radicals. This decrease the antioxidant system function and produce oxidative stress (Żukowski et al., 2018).The concentration of free radicals increase during hyperglycemia condition. The four pathways involved in this process

- Increased glycolysis
- Accumulation of fructose or sorbitol occur by activated sorbitol
- Oxidative stress produced by protein glycation without enzymes.
- Different radicals produce by the auto oxidation of glucose (Żukowski et al., 2018).

During diabetes mellitus, the process of glycolysis increases which results produce &the pyruvate and increase the mitochondrial potential. In electron transport chain this potential disturb the functions of mitochondria and increased the production of ROS (Żukowski et al., 2018).

3.2.2 Neurodegenerative disease

Our central nervous system has high concentration of lipid, low level of antioxidants, and high utilization of oxygen so it is very sensitive to is very sensitive to oxidants(Sun et al., 2018).Some regions of brain substantia nigra, striatum and hippocampus are very sensitive to attack by free radicals. ROS species produces the lipid peroxidation process which causes decrease membrane potential,loss of membrane fluidity, increase ions permeability (Sun et al., 2018). Several neurodegenerative diseases are associated with this oxidative stress (Sevcsik et al., 2011). These disorders are Parkinson's, Alzheimers, Huntington (Sun et al., 2018).

3.2.3 Alzheimer disease

Amyloid protein improper functioning and folding occur in alzheimer patients. Plaques of amyloid protein formed in this disease (a global brief on hypertension, 2013.)AD characterized by accumulation of intracellular neurofibrillary tangles of tau protein (Gupta et al., 2020).

Hyperphosphorylation of tau protein occur.The hyperphosphorylation process produce neurofibrillary tangles and produce hydrogen peroxide (h2o2) which give results the production of toxic free radical OH by metal catalysis process. In AD patients the functions of ion pumps,glutamate transporters, glucose transporters also disturb (Gupta et al., 2020)

3.2.4 Cardiovascular Diseases

These diseases involved the heart and blood vessels that are class of pathologies. Also include vascular diseases of kidney and brain and cardiac diseases. As compared to other diseases, mostly people are dying due to the CVDs. Free radicals plays the role in the vascular inflammation and proliferation (Hu et al., 2018).

Oxidation of low density lipoprotein leads to accumulate in the plaque by the production of ROS. It results the inflammation during atherosclerosis. Cell death by apoptosis process and the function of endothelial cells disturb and produce vasoconstriction (Satta et al., 2017). This all due to oxidized low density lipoprotein. Free radicals linked in the production of congestive heart failure. There is a direct link between in the formation of free radicals and congestive heart failure by experimental proved (Hu et al., 2018).

3.2.5 Cancer

Free radicals cause different changes in the body and cause cancer that is the major cause of human death. ROS free radicals are higher in the cancer cells as compared to the normal cells (Satta et al., 2017). Due to high metabolic rate of ROS radicals, gene expression and growth signaling changes that may defect the DNA by different ways such as DNA methylation, strand breakage, base modification and deletions. This may cause cancer (Lai & medicine, 2019).

3.2.5.1 Breast cancer

Breast epithelium damage by free radicals species. One of the cause to increase oxidative stress in breast cancer is the over expression of this enzyme which play its role in conversion of thymidine to thymine and 2-deoxy-D-ribose-1-phosphate is catalyzed by thymidine phosphorylase enzyme. Oxygen radicals produce by reducing sugar which glycates the protein. This oxygen radicals have role in cancer cells (Lai & medicine, 2019).

3.2.6 Multiple Sclerosis

Demylination of central nervous system occur and results not proper conduction of nerve. It is autoimmune neuronal disorder. Production of free radicals by the activation of macrophages which start this process. In the progression of disease, not proper metabolism of iron also play important role (Losada-Barreiro & Bravo-Diaz, 2017).

3.2.7 Free radicals and aging

During early age the change in aging processes are very rare but increase fastly by with age. This is due to the epidemic nature of aging. Aging is the process in which developing decline the regulation of physiological and biochemical reactions (Satta et al., 2017). Many theories have been explained to describe the effect of free radicals on aging but most popular one is" the free radical theory of aging" that is proposed by which achieve most acceptance. It is stated that the destruction of free radicals can increase aging and by the production of free radicals (Losada-Barreiro & Bravo-Diaz, 2017).

This theory hypothesize that destruction of cellular components occur by the oxidative stress produced by free radicals. It results change the cell functions, organ function, compacted tissues and leads to death. The oxidative phosphorylation induce by the molecular oxygen taken by body in mitochondria, free radical produce by this and other metabolic processes and produce oxidative stress on macro-molecules (Satta et al., 2017). The theory of free radicals is supported by the "rate of living". It postulates that the long life spanning of organism is inversely link to the metabolic reactions and with increase the age the oxidative stress also increase on the lipids, DNA and proteins. Experiment had been proposed on animals to support the evidence of free radicals theory. In rodents, the decease the oxidative stress, increase life span and increase the defense of of free radicals by limiting the caloric intake (Moein, Moein, Fard, Sabahi, & Technology, 2017).

Normal metabolism produce free radicals which play important role in many physiological and pathological functions. When free radicals lead to accumulate and cause to damage macro-molecules protein, lipid, nucleic acid due to disturbance the balance between oxidants and antioxidants (Moein et al., 2017).

4. Antioxidant System & its Mechanism

Antioxidant is a molecule which stables the free radical by donating an electron to it and neutralize its ability to damage. Antioxidants can stop the cell damage through the free radical salvage property. Antioxidants are the low molecular weight compounds which can interact with free radicals and end the process of damaging (Qazi, Molvi, & Research, 2018). Some of antioxidants produce during normal metabolism in body i.e uric acid and glutathione. Other antioxidants present in diet. Several enzymes and vitamins play the role of antioxidants. Some micro-nutrients cannot synthesized in the body. These nutrients supply through diet(Sundaram Sanjay & Shukla, 2021).

Antioxidants may be well understood due to having the information of their nature of reactivity of ROS. The word "antioxidant" leads to any molecule having the ability of deactivating the free radicals before their attack to cells (Qazi et al., 2018). Humans having highly complicated system of antioxidants which provides the protection to the organ systems and cells of the body. A good antioxidant should be soaking up and kill the radicals. Antioxidants that originate internally play an important role in maintaining the maximum functions of the cells. When these antioxidants may not be enough then these are obtained from diets for proper functions (Sundaram Sanjay & Shukla, 2021).

4.1 Antioxidants Groups

There are two major groups of the antioxidants

1. Enzymatic Antioxidants
2. Non-Enzymatic Antioxidants

4.1.1 Enzymatic Antioxidants

Most effective enzymatic antioxidants contain superoxide dismutase, glutathione peroxides and catalase (Thirunavukkarasu et al., 2019).

4.1.1.1 Glutathione peroxidase

Glutathione peroxidase is an enzyme which has two forms that are selenium-independent (glutathione-S-transferase, GST, EC2.5.1.18) and selenium dependent (GPx, EC1.11.1.19) (Thirunavukkarasu et al., 2019). Main differences between these forms are the bonding of selenium at the active centre, catalytic mechanism and number of sub-units. There is only one important defensive mechanism of the antioxidant present in the cells is glutathione metabolism. In humans, four different types of this enzyme is present that are Se-dependent glutathione peroxidase (Thirunavukkarasu et al., 2019).

Elimination of the peroxidase for Fenton reaction is allowed by the seleno-enzymes. Selenium-dependent glutathione peroxidase acts with the GSH that is tripeptide glutathione and highly present in cells and it break

down the organic peroxide such as Hydrogen peroxide into alcohol and water. It is highly protective to the low levels of oxidative stress (Wei et al., 2021).

4.1.1.2 Catalase

The presence of this enzyme is highly in the aerobic cells of Peroxisomes. It is most effective to convert the organic peroxide into molecular oxygen and water. The turnover rate of this enzyme is high such as in every minute it converts 6 millions of molecules (Wei et al., 2021).

4.1.1.3 Superoxide dismutase

Most efficient enzyme of antioxidant is superoxide dismutase. It highly converts the anions of the superoxide into the hydrogen peroxide and dioxygen. It consists of many isoforms that are different in many features such as co-factor, composition of the amino acids and active centre of metal. In humans, there are three types of this enzyme is present that are extra cellular-SOD (Qazi et al., 2018).

Cytosolic Cu and mitochondrial Mn-SOD. The molecular weight of the two same subunits of the Cu, Zn-SOD is 32 kDa. Both subunits consist of the dinulcear metal cluster and active site that break down the anions of the superoxide into water and oxygen. The molecular weight of the mitochondrial Mn-SOD is 96 kDa and each subunit of this enzyme consists of one manganese atom. The regulation of this enzyme by cytokines may occur in the mammalian tissues primarily (Alkadi, 2020).

4.1.2 Non- enzymatic antioxidants

Non-enzymatic antioxidants may contain natural flavonoids, melatonin, Thiol antioxidants, carotenoids and vitamin C and E (Alkadi, 2020).

4.1.2 Vitamin C

It is also known as ascorbic acid. It is soluble in water so it works well in the aqueous medium of human body. It is the major form of the antioxidant. The carotenoids and Vitamin E is the primary partner of this Vitamin C. With the help of vitamin E, this vitamin converts the α-tocopherol radicals into its original form α-tocopherol in the lipoproteins and membranes of cell. It plays a major role in the protection of the protein Thiol group by increasing the glutathione levels from the antioxidant (Atwood, Huang, Moir, Tanzi, & Bush, 2018).

4.1.3 Melatonin

This is also known as (N-acetyl-5-methoxytryptamine) and it is a neuro harmone that is mostly produced in the gland of the pineal. It has many functions but most important function is to give the protection of proteins, DNA and cell membrane from the damage of the free radicals. So they reduced the diseases that are produced by the free radicals (Atwood et al., 2018).

4.1.4 Carotenoids

These are the pigments that are naturally colored and present in both small organisms and plants. They mostly present in the diet. High level of these pigments in the diet may cause the diseases that are related to the age. A conjugated double bound is present in these pigments (Poprac et al., 2017). Delocalization of the single electrons is the characteristic of these pigments which may increase the activity of the antioxidants. The function of the pre-oxidant is carried out by the carotenoids β-carotene which may increase the level of the peroxidation of lipids (Engwa & Demand, 2018).

Antioxidants may be effect by the pressure of oxygen and the concentration of these colored pigments. When the pressure of oxygen is very low then they show the characteristics of the antioxidants but when the pressure of oxygen and concentration of this pigment is high then they become pro-oxidant (Engwa & Demand, 2018).

4.2 Antioxidants Mechanism

Two mechanisms of action of antioxidants. The initial is a chain- breaking mechanism by which the first antioxidant donates an electron to the free radical present in the systems (Poprac et al., 2017). The second mechanism involves removal of secondary antioxidants by termination chain-initiating catalyst (Guan & Lan, 2018).

4.2.1 Levels of antioxidant action

- The first line of action is the obstructive antioxidants, which control the formation of free radicals. To suppress such reactions, some antioxidants reduce hydroperoxides and hydrogen peroxide advance to alcohols and water, respectively, without production of free radicals(Peña-Bautista et al., 2019).

- Glutathione peroxidase, glutathione-s-transferase, phospholipid hydroperoxide glutathione peroxidase (PHGPX), and peroxidase are known to decompose lipid hydroperoxides to corresponding alcohols. Glutathione peroxidase and catalase reduce hydrogen peroxide to water (Poprac et al., 2017).
- The second line of action is the antioxidants that scavenge the active radicals to inhibit chain initiation break the chain propagation reactions. Various endogenic radical-scavenging antioxidants are known: some are hydrophilic and others are lipophilic. Vitamin C, uric acid, bilirubin, albumin (Peña-Bautista et al., 2019).
- The third line of action is the repair and de novo antioxidants. The chemical change in enzymes, proteinases, proteases, and peptidases, present in the cytosol and in the mitochondria of mammalian cells, recognize, degrade, and remove oxidatively modified proteins and prevent the accumulation of oxidized proteins (Guan & Lan, 2018)**.**

5. Different Herbal Sources of Natural Anti-oxidants

5.1 Natural antioxidants from Plants

The extraction of the antioxidants is obtained by different sources. These are also obtained chemically by fruits, vegetables, teas, coffee, spices, herbs and some other sources like algae etc. Some sources are given below (Alam, 2019; Ejaz et al. 2021).

5.1.1 Antioxidants from vegetables

The risk of the cardiovascular and cancer diseases has been reduced by using the fruit and vegetables. Antioxidants are extracted from different vegetables such as green leafy vegetables which include lettuce, spinach etc., cruciferous vegetables which include cabbage, Brussels sprouts, broccoli etc., root and tuberous crops which include red beets, sweet potatoes, carrots and potatoes etc., tomatoes, onions and some other vegetables (Alam, 2019).

Different vegetables are used for the production of the antioxidants so different methods are used for the extraction of the antioxidants. Some scientists studied on these antioxidants. Pro-oxidants are produced initially by the juices of some vegetables at 2°C. The activity of the production of the pro-oxidants is high for yellow bell pepper, egg plants and tomatoes (Fei et al., 2020). The activity of antioxidants is increased by boiling in case of the eggplant, garlic, tomato and carrot. The pro-oxidant activity is inhibited at very high temperature because it is due to the presence of the enzyme peroxidase that is inactivated at high temperature. The study of the commercial antioxidants like Vitamin C, tocopherol, flavanoids, carotenoids and phenolic acids has been more focused by scientists. These commercial compounds are present in some vegetables (Alam, 2019).

5.1.2 Root and tuberous vegetables

The activity of the antioxidants is very low by root and tuberous vegetables such as carrots than the other vegetables. The antioxidants are extracted by carrots at 40°C. The activity is increased by boiling for 30 minutes. Some antioxidants like a-tocopherol, Vitamin C and polyphenols are extracting by potatoes that are the good source of these antioxidants. The high activity of antioxidant is shown by the peeling of the potatoes (Fei et al., 2020). This is studied by the Lugasi et al. Hayase and Kato has been studied that the enzymatic browning is done by the compounds of phenols that are work in sweet potatoes as an antioxidant.

The activity of antioxidants by the purple potatoes is much greater as compared to the other forms of potatoes i.e. yellow and white potatoes. Due to the presence of the anthocyanins like pelargonidin-3-rutinoside-5-glucoside in the purple potatoes, the activity of the oxidants is differing than the others (Jadczak, Kulpa, Drozd, Przewodowski, & Przewodowska, 2020). Strong antioxidants are obtained by the sweet and purple potatoes due to the presence of the peonidin glycoside that is another form of anthocyanins. High activity of antioxidant is seen by the peel of sugar beet and the beet root (Fei et al., 2020).

5.1.3 Cruciferous vegetables

Cruciferous vegetables consist of the glucosinolate and by products that are bioactive in nature. The characteristics of the antioxidants are shown by some cruciferous vegetables such as white cabbage, cauliflower, Brussels sprouts, red cabbage and broccoli (Jadczak et al., 2020). Due to the component of the glucosinolate, the action of the antioxidants is not done directly. But these vegetables contain the components of the polyphenols

and hydroxylated phenol that perform the total activity of the antioxidants. Higher activity of the antioxidants is performed by the broccoli and Brussels sprouts (Li et al., 2020).

5.1.4 Green leafy vegetables

Green leafy vegetables such as spinach show very low activity of the antioxidants. Spinach contains the phenols that are higher in the lipoproteins content that provide the protection by the process of the oxidation (Li et al., 2020). The poor activity of the antioxidants is done by the iceberg lettuce and leaf lettuce but high activity is done by the spinach. The effect of the inhibition on the lipid peroxidation is increased by mixing of the two to four green leafy vegetables that contain spinach also. This inhibition is due to the presence of the high content of the antioxidants in the spinach (Riaz, Riaz, Shahzad, Ijaz, & Khan, 2020).

5.1.5 Onions

Towards the oxidation of the methyl linoleate, the activity of the antioxidants is very low by the red and yellow onions but towards the LDL, the activity of antioxidants is high. In ORAC, the activity of the antioxidants is very low by the onions but it is fourth time higher than that of the onions by garlic. The oxidation of the lipid of Phosphatidylcholine liposome is delayed by the bulb of onion, scallions, bulb of shallot, bulb of garlic, Chinese leek and green garlic (Riaz et al., 2020).

The activity of the antioxidants is done by the allicin 4 of the garlic bulb. The activity of the antioxidants is very powerful showed by those vegetables that are rich in the anthocyanins such as red onions. The activity of the antioxidants is double by the green onions.

5.1.6 Other vegetables

The high amount of the components of the phenol and lycopene 6 is present in the tomatoes. In some studies, the activity of the antioxidants is shown by the tomatoes. The absorbance of the radical of oxygen is very high in the juice of tomatoes as compared to the juices of the apple and orange in some commercial tests of juices. The activity of the antioxidants is decreased by heating 2-5 hours of tomato juice (Somani, Husain, & Schlorff, 2017). The peroxidation of lipids is stop by the tomato juice in the homogenates of beef. The effect on the activity of the antioxidants is due to the synergism that is present in many components of the tomato. The low activity of the pro-oxidants and antioxidants is shown by the bell-paper. The activity of the antioxidants is also shown by some other vegetables such as corn, zucchini, pea, asparagus, celery, eggplant ant cucumber (Somani et al., 2017).

5.1.2 Antioxidants from fruits and berries

By using the different methods of the analyzing of antioxidant and oxidation, many fruits, berries, wines and juices are used to perform the activity of the antioxidants. Phenolic acids and flavanoids are present in the fruits and berries that effect the activity of the antioxidants. The activity of extraction of the antioxidants is very high by the fresh strawberries than the other fruits such as pear, apple, honeydew melon, pink grapefruit, plum, red grape, tomato, white grape, banana, kiwi fruit and orange. Strawberries contain the phenols that extract the active antioxidants. Different methods are used for the extraction of the antioxidants so different antioxidants are produced (Somani et al., 2017). Some fruits and berries used same and one method foe the extraction of the antioxidants. The extraction of the antioxidants from some different fruits is given below (Somani et al., 2017).

Table 5.1: Antioxidant compounds identified in different fruits and berries

Fruits and berries	Antioxidatives compounds	References
Apple juice	chlorogenic acid, phloretin glycosides, ascorbic acid	Somani et al., 2017
Grapes	total phenolic, anthocyanins, flavonols, Maldivian 3-O-(6-O-pcoumaroylglucosido)-5-glucoside	Sun et al., 2018
Red wine	anthocyanins, catechin, gallic acid, resveratrol	Somani et al., 2017
Peach	chlorogenic acid, neochlorogenic acid	Sun et al., 2018
Orange juice	hesperidin, narirutin	(J. Wang et al., 2021)

Tart cherries	cyanidin, 6,7-dimethoxy-5,8,4¢-trihydroxyflavone, genistein, chlorogenic acid, naringenin, genistin, 2-hydroxy-3-(ohydroxyphenyl) propanoic acid, 1-(3¢,4¢dihydroxycinnamoyl)-cyclopenta-2,5diol, 1-(3¢,4¢-dihydroxycinnamoyl) cyclopenta-2,3-diol	53, 54, 55	Sun et al., 2018

5.1.2.1 Stone fruits

Two phenolic compounds are present in the prunes and prune juices that are predominant and these are antioxidants. The activity of the antioxidants is two time higher by the prunes as compared to the other fruits like blueberries and raisins. Seven times less activity of antioxidants is done by the plums than the prunes (Sun et al., 2018). Peach including the raw and canned peach inhibit the oxidation of the low density lipoproteins. Due to the presence of the neochlorogenic acids, chlorogenic and hydroxycinnamic acids in peach, 56-80% activity of the antioxidants is done. But peaches don't contain the carotenoids like b-cryptoxanthin and b-carotene. The activity of the antioxidant is low by the peel of peach (Sun et al., 2018).

5.1.2.2 Citrus fruits

The extraction of the inhibited ascorbate-iron is less effective to the antioxidants by the grape fruits. The peroxidation of the lipids is not performed by the component naringenin 7-b-neohesperidoside that is the main component of grape fruit. The activity of the Peroxyl radicals is highly active by the orange as compared to the pink grapefruit but this is highly active by the juices of grapefruit rather than the juices of the orange(Sun et al., 2018).

Antioxidants that are obtained by some citrus fruits like grapefruit, tangerines and orange don't effective to the oxidation of the lipoproteins. In citrus fruits, two main phenolic compounds hesperidin and hesperetin is present that don't show any activity of the antioxidants (J. Wang et al., 2021). The total activity of the antioxidants is done by the two main components of the orange juices that are narirutin 10 and hesperidin 9. The activity of the antioxidants is much greater by the citrus juices of the industry such as sour orange, lemon seeds, lime, sweet orange, mandarin, pummelo and bergamot (J. Wang et al., 2021).

5.1.2.3 Grapes and wines

Both grapes and the juices of the grapes consist of the antioxidants. The phenolic antioxidants are present in both commercial and fresh grapes. The inhibition of the oxidation of the low density lipoproteins is due to the 20-60%fresh grapes but 68-75% due to the commercial grapes in humans. The activity of the antioxidants in grape juices is not effect by the vitamin C. In lecithin liposomes, the formation of both hexanal and hydroperoxides is inhibited by the extraction of the grapes. Wild grapes isolate the main component of the anthocyanins that is malvidin3, 5-diglucoside 11. The antioxidants produced by the grapes are phenolic compounds (J. Wang et al., 2021).

The oxidation of the low density lipoproteins is decreases by the enzymes used in the grapes. The most efficient compound is produced by the seeds of the grapes that are procyanidin B2 3¢-O-gallate 13. Electron spin resonance can measured the reduce radical species that are produced by the seeds of the grapes. Wines such as red wines produced the powerful antioxidants (J. Wang et al., 2021). In the oxidation of the reduced LDL lipids, the activity of the tocopherol is less effective than the activity of the phenolic antioxidants produced by the wines. The compound of phenols such as resveratrol 16, catechin 14, Gallic acid 15 and anthocyanins are responsible for the activity of the antioxidants in the red wines. Red wines also extract the two antioxidants such as flavonols and quercetin in a low amount that is measured by the electron spin resonance (J. Wang et al., 2021).

5.1.2.4 Berries

Antioxidants such as phenolic acids, ascorbic acids, carotenoids, flavanoids and tocopherol are extracted by the berries. High activity of the antioxidants is exerted by the powerful berries such as cranberry, wild berry, aronia, rowanberry, crowberry and lingonberry. The low activity of the antioxidants is exerted by the cultivated berries such as blackcurrant, raspberry, redcurrant and strawberry (Zhang et al., 2020).

The active phenolic compounds of antioxidants extract by the wines of berries. The extraction of the oxidation of the inhibited low density lipoproteins is done by the berries. Blueberry has activity of the antioxidants three fold higher than the strawberry. The activity of the antioxidants is exerted by the tart cherries. Tart cherries perform the high and strong activity of the antioxidants (Zhang et al., 2020).

5.1.2.5 Other fruits

The powerful activity of the antioxidants extract by the apple. A low activity of the total antioxidants is performed by the vitamin C that is present in the juice of apple. The strong activity of the antioxidants is performed by the polyphenols of the apple such as phloridzin 29, dimer (procyanidin B2) 28, chlorogenic acid, 3-hydroxyphloridzin 30, oligomers, guercetin glucosides and tetramer from gala apple pomace (Zhang et al., 2020).

The activity of the antioxidants is performed by the other fruits such as honeydew melon, banana, kiwi and pear fruit. Recently it is reported that Olives also exert the activity of the antioxidants. From the point of safety, the most important compounds that exert the activity of the natural antioxidants are spices, teas and herbs. These herbs, teas and spices are very useful for both the medical and antiseptic applications. There are more than 70 teas, herbs and spices that are interested in the activity of the antioxidants examined (Zou et al., 2019). The most efficient activity of the antioxidants is indicated by the two spices that are sage and rosemary. There are 17 different spices were observed to exert the activity of the antioxidants. The high activity of the antioxidants is indicated by the oregano, mayonnaise and French dressing. In meat lipids, the activity of the antioxidants depends on the concentration of the thyme, oregano, ground clove, sage and ginger. The activity of the antioxidants is slightly higher shown by the rosemary (Zou et al., 2019).

Table 2.2: Antioxidants are isolated from herbs, spices and teas

Species	Substances and types of substances	References
Rosemary	Carnosic acid, Carnosol, rosemarininc acid, rosemanol	Zou et al., 2019
Sage	Carnosol, carnosic acid, rosemarininc acid, rosemanol	Zhang et al., 2020
Green tea	Catechin	Zhang et al., 2020
Black tea	Theaflavins, Thearubigins	Zou et al., 2019
Oregano	Derivatives of phenolic compounds, flavanoids and tocopherol	Zhang et al., 2020
Thyme	Thymol, carvacrol, biphenyls	Zhang et al., 2020
Summer savory	Carnosic acid, carnosol, rosemarininc, thymol and carvacrol	Zou et al., 2019

5.1.2.6 Rosemary and Sage

In food processing, the most efficient spices that is used is rosemary. In United States and Europe, only spices are available as antioxidants. The products that are extracted by the rosemary are not listed as natural antioxidants due to their use as agents of flavors (Zou et al., 2019).

The products of food that are extracted by the rosemary depend on the model of test. A large number of the products is obtained by the rosemary. For the extraction of the antioxidants, many solvents are used. The greater antioxidants are obtained by the rosemary are hexanes. The most effective antioxidants obtained by the rosemary and sage are hexane in the bulk of rapeseed oil. The antioxidants that are extracts by the rosemary are more active as compared to the sage (Zou et al., 2019). The activity of the antioxidants by the rosemary is higher than the carnosol. The activity of the antioxidants is decreased by the portioning of the interfacial of the rosemary compounds.

The strong inhibitors of the peroxidation of the lipids in the system of liposomal and microsomal are carnosic acid and carnosol. The antioxidants that are extracted by the sage are growing. The major effect of the Antioxidatives activity is due to the presence of the rosemarininc acid, carnosic acid and carnosol in the sage. The most suitable solvents for the extraction of the antioxidants are ethanol and methanol from the materials of

the plants. On the scale of the production, two methods are mostly used such as molecular distillation and steam distillation (Zou et al., 2019).

5.1.2.7 Teas

It is a beverage that is develops by the one of the spices that is Camellia sinensis plant. There are three main forms of teas that are produced in the tropical and subtropical areas. These forms are black tea, green tea and oolong tea. Ethanol is extracted by these teas. In 1995, Zandi and Gordon published that the natural source of the natural antioxidants was teas. Many products of the antioxidants are obtained by the teas such as methanol is extract by the black and green teas (Zou et al., 2019).

There are three major groups of the polyphenols such as theaflavins, thearubigins and catechin that are present in the teas. The main constituents of the green tea are catechin. Against the oxidation of the lipids, the extraction of the green tea is more effective than the extraction of the rosemary. The phenolic compounds had a strong activity that is derived from the green tea. The good source of the superoxide is polyphenols that are extracted by the green tea. The compound of antioxidants is extracted from the tea of barley in the hot water. The healthy antioxidants also extract by the tea of rooibos that are present in the South Africa (Zou et al., 2019).

5.1.2.8 Summer savory

The herb that is widely used in the food industry is summer savory. The good oxidative effect is shown by the ethanol that is extract by the summer savory. Methanol is also extract by this herb. The carvacrol, thymol, rosmarinic acid, carnosic acid and carnosol are those antioxidants that are extracting from the summer savory. Thymol antioxidants are not present in the oil of the summer savory (Adhikari et al., 2018).

5.1.3 Antioxidants from Legumes

Poly phenolic and phenolic acids are those antioxidants that are extracting from the different legumes such as peas, beans and peanuts. Phenolic oligomers with low molecular weight in the 7-9% procyanidins were found in the red peanuts. The flavan3-ols of catechin and epicatechin are the phenols with low molecular weight. The better antioxidants that are extracted from the peanuts are ethanol, acetone and methanol. The 2000 and 1750mgg-1 phenolic acids are obtained from the meal and flour of the peanuts respectively. The highly purified products of antioxidants are obtained by the formulas of flour to food and meal of peanuts. Hydrogen donating antioxidants are tocopherol that is present in the peanut oil. The antioxidants activity is enhanced by the roasting of peanuts(Adhikari et al., 2018).

6. Beneficial & side effects of Anti-oxidants

6.1 Beneficial Effects of the Antioxidants

The unpaired electrons are present in the outer most shell of the highly reactive species such as free radicals. The degeneration and death of the cells is due to the reaction of the free radicals with the membranes. Antioxidants are produced from these radicals. Different chemical compounds found in the polluted air and water combines with these radicals in the blood. Different neurological diseases such as Alzheimer and Parkinson's are due to the free radicals (Adhikari et al., 2018).

The antioxidants are provided to the body to nullify the effect of the radicals. The destruction of free radicals is due to the complex of the antioxidants. Fresh fruits and vegetables contain a large amount of the antioxidants. Flavanoids and antioxidants present in the fruits and vegetables give the protection from many problems of the health including cardiovascular and many types of the cancers. Many diseases are also protective by the antioxidants. There are many applications in which antioxidants are involved. Some of them are given below (Ahmadifar et al., 2019).

6.1.1 Food antioxidant

The food products that are being marketed contain large amount of the polyunsaturated and unsaturated fats. These foods are being used by the people to stay fit and healthy. Scale of certain parameters is used to measure the quality of any products. Different parameters like taste, aroma and its appearance are used to check the quality of the food. There are different types of the food that are available due to the changing in the life style of the people. There is a potential need of the antioxidants that are the protective agents of the health. To prevent the food from the spoilage, there are many types of the antioxidants that are used in the fat, oil and food processing industries as additives. The good source of the potential antioxidants is obtained by the spices and herbs are used in the food to prevent from turning the rancid (Ahmadifar et al., 2019).

Due to the addition of the antioxidants in the food, the oxidative stress is being reduced. The components that consist of the antioxidants properties are obtained by the spices, herbs, tea plants and vitamins. Phenolic compounds stop the oxidation reactions by removing the free radical chain and producing the chelating of the transition elements, in this way they act as reducing agents. The production of the off odour and tastes is also inhibited by them. Multiple antioxidants such as vitamin E and C and selenium act as anti-inflammatory and anti-carcinogenic agents. There is a potential need to maintain the complex system of these antioxidants. The structural integrity of the tissues is also protective by these antioxidants. They play a potential role in food (Ahmadifar et al., 2019).

6.1.2 Role in premature infants

Due to the high production of the ROS, the injuries in the infants are decreased by the enzymatic and non-enzymatic antioxidants. These antioxidants are beneficial in the treatment of necrotizing enter colitis, retinopathy of prematurity, bronchopulmonary dysplasia and periventicular leukomalacia. The injuries in the infants produced by the ROS are decreased by the over expression of the antioxidants. An indirect effect of the antioxidants by supporting the glutathione peroxidase and SOD activity and also a direct effect by the oxidation of the lipids is shown by the pineal hormone that is Melatonin. Both antioxidants such as enzymatic and non-enzymatic show resistance to the oxidative stress(Ahmadifar et al., 2019).

The metabolism of iron includes the transferrin, ferroxidase and ceruloplasmin all act as powerful oxidizing agents. The production of the antioxidants is also increased due to the bioavailability of the proteins. Vitamin E and C and selenium are the nutritional antioxidants that show the anti-carcinogenic and anti-inflammatory effects. The structural integrity of the hypoxic tissue is also protective by the antioxidants. The supplementation with the high dose of the nutritional antioxidants provides the protection and treatment for some diseases such as diabetes, cancer, cardiovascular and inflammation. In food system and in the human body, antioxidants play an important role in reducing the oxidative stress. The oxidative damage is caused by the reactive oxygen species are protected by the antioxidants in the body of the humans (Aliko et al., 2018).

6.1.3 Antioxidant nervous system

The oxidative damage of the cerebellar development is prevented by the antioxidants. For the maintenance of the Wellness, antioxidants also plays an important role. For acute injury of the central nervous, antioxidants are used as therapeutic agents (Aliko et al., 2018).

6.1.3.1 Antioxidants and Red Blood Cells

Red blood cells also known as erythrocytes. Their main function is to transport the oxygen carbon dioxide throughout the capillaries and lungs. RBCs are damaged by the ROS that are produced by the antioxidation of the oxyhaemoglobin. Enzymatic antioxidants are present to prevent this damage in the RBCs. The whole RBCs are protected by the glutathione peroxidase that is cooperated with the catalase (Aliko et al., 2018).

6.1.3.2 Antioxidants and their therapeutic usage

Many antioxidants are the good source in preventing the cardiovascular diseases that are obtained by the vegetables and fruits. Many neurodegenerative diseases such as amylotrophic lateral sclerosis, Parkinson's disease and Alzheimer disease are also protected by the antioxidants. Several pathological disorders such as acquired immune deficiency, cardiovascular disease, rheumatoid, ulcerogenesis and arthritis are due to the high oxidative damage (Da Silva, Fontes, & Modolo, 2017).These pathological disorders are also treated by the antioxidants. Many other health diseases such as depression, leukemia, post menopause of women, hemodialysis, stroke and thalassaemia also treated by the antioxidants. The supplements of the antioxidants play an important role in the treatment of the diseases that are caused by the oxidative stress such as anxiety and psychiatric disorders (Da Silva et al., 2017).

6.2 Side effects of the Antioxidants

A phenomenon is produced due to the excess amount of the oxidative and free radicals known as oxidative stress. The structure of the cell membrane and the others such as lipids, proteins, deoxyribonucleic acid and lipoproteins are also changed by this stress. When the excess amount of the free radicals is not destroyed properly then oxidative stress is produced. When an imbalance in the formulation and neutralization of the RNS/ROS produced then this oxidative stress is also produced. The peroxidation of the lipids is occurred that damage the many cells of lipids. The structure of the proteins is also altered and loss of the activity of the

enzymes is due to this stress. Mutation occurs in the DNA due to the oxidative stress. Oxidative stress can cause many acute and degenerative diseases as well as some ageing process and in some chronic pathology such as trauma and stroke (Da Silva et al., 2017).

6.2.1 Cancer and Oxidative stress

Cellular and molecular changes may occur due to the stimuli in the body which may lead to the production of the cancer. The development of the cancer is due to the oxidative changes in the DNA. Free radicals induce the chromosomal defects which lead to the initiation and promotion of the cancer cells in the body. An important event in the chemical carcinogenesis is the formation of hydroxyled bases of the DNA (El-Esawi et al., 2018).
As a result, the transcription of gene is altered and mutations occurred. For example, the sources of the oxidative DNA damage are the noninfectious diseases such as asbestos may cause the acute inflammation which may lead to the lung cancer and other tumors (Da Silva et al., 2017).

6.2.2 Pulmonary diseases and oxidative stress

Some inflammatory lung diseases such as acute obstructive pulmonary disease and asthma are due to the oxidative stress. Oxidants play an important role in the activation of the kinases and redox transcription factors which enhanced the inflammation (El-Esawi et al., 2018).

6.2.3 Nephropathy and oxidative stress

Many renal diseases such as uremia, glomerulonephritis, proteinuria, tubulointerstitial nephritis and chronic renal failure are due to the oxidative damage. The oxidative stress plays a role in the nephrotoxity of some drugs such as vinblastine, cyclosporine, gentamycin, tacrolimus and bleomycin (Hasanuzzaman et al., 2020).

6.2.4 Ocular disease and oxidative stress

Cataracts by changing the many types of the cells in eye and degeneration of the age related muscles are also produced due to the oxidative stress. Cataracts are produced due to the crystalline proteins that are cross linked and aggregates in the lens due to the free radical action. The peroxidation of the lipids is associated with the damage of the photoreceptor outer segments (Hasanuzzaman et al., 2018).

7. Conclusions

This is universal agreement that free radicals involved in the physical, biochemical and pathological changes associated with aging. As the oxidative stress increase it produce destruction in biomolecules. This stress can be inhibit by different types of antioxidants specially obtained from natural source like ascorbic acid, polyphenols, enzymes, tocopherol and carotenoids. This destruction cause many diseases such as cardiovascular, neurological, cancer and diabetes. In spite many other substances obtained from inhalation, drinks and foods such as ultraviolet radiations should be destructive the health and long life. The extraction method of natural antioxidants resources are food and plants. These extraction methods have higher extraction yield, less time usage, low energy usage as compared to conventional method. It has been identified that on world-wide antioxidants compounds obtained from plants have high potency have low side effects for use in food and medicine industry. Today the modern era, have high use of smoking, pollutants, alcohol and pesticides uptake and some medicines increase the chance of diseases due to free radicals. We obtained large amount of antioxidants from plants to prevent this oxidative stress. So it is concluded to sustain a healthy life we have to take antioxidant rich food. It is better to take antioxidants compounds from fresh vegetables and fruits as compared to dietary supplements. Antioxidants rich diet overcome all these diseases which arises due to oxidative stress and provide a healthy and long life with lower health risks.

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