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Chapter

Importance of the Nutrition with Antioxidants in the Treatment of Cancer and Others Damages

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Abstract

The antioxidants are molecules capable of retarding or anticipating the oxidation of other molecules. Epidemiological results have shown that the persons who consume a rich diet of fruits and vegetables present a minor risk of suffering different types of cancer, cardiovascular and neurological diseases, and a minor mortality than the persons who consume few fruits and vegetables. Others studies suggests that the vitamins are antioxidants like can to decrease hurt oxidative in the physiopathology of many chronic diseases and cancer.

Nevertheless, evidence of new studies in mice shows that vitamins can promote the growth of tumors and metastasis and the expression of the gene p53. Current studies indicate that patients with cancer and people who have a major risk of cancer will have to avoid taking complements of antioxidants, due to the fact that it was thought that antioxidants might protect cells against cancer since they neutralize reactive oxygen species (ROS) that can damage the DNA, but in studies of animals, it has been indicated that the presence of major concentrations of antirust exogenous prevents the type of hurt of free radical that has been associated with the formation of cancer.

Keywords: nutrition, antioxidants, treatment, cancer, diseases

1. Introduction

Antioxidants are molecules that act disabling the reactions of oxidation in chain that they produce cellular hurt withdrawing radical free and disabling other reactions of oxidation.

Production of free radicals is regulated by different metabolic routes, and they are considered as the first line of defense in the human body.

Currently, consumption of foods rich in antioxidants such as functional foods as omega-3 and glutamine [1] plays an important role in the nutrition of the population. As functional foods that contain fiber, vitamins, minerals and which decrease saturated fats or sugars are considered [2].

The advantages of the consumption of antioxidants have been reported, but currently a research has discovered the disadvantages in their consumption; for example,

vitamin A and N-acetyl-cysteine dosed to mice induced with lung cancer increase the size of the tumors, and these substances can eliminate the expression of the gene *p53* (suppressing gene of tumors) activated when hurt exists in the DNA [3].

On the other hand, a functional food is according to the ESPEN guidelines a "food fortified with additional ingredients or with nutrients or compounds intended to yield specific beneficial health effects." Functional foods can be prepared with vitamins and minerals or other compounds of nutritional or physiological effects, and their dose form can be different [4].

In Europe and USA the consumption of dietetic supplements more commonly are antirust vitamins and mineral supplements.

This paper explains the importance of the consumption of antioxidants in the human nutrition and in patients with cancer, who have been treated with chemotherapy and radiotherapy, and their use to other diseases has been mentioned.

2. Functional foods

A functional food is a nutritional food with vitamins and minerals and other compounds functional in the body; they are also known as antioxidants. In the **Table 2** we show some antioxidants report in the literature.

2.1 Glutamic acid

Glutamic acid is a nonessential amino acid and has functions that allow it to interact with other biological biomolecules in order to maintain energy between tissues for the synthesis of molecules and lead to cell growth [1].

This amino acid is considered for its function as a neurotransmitter in its molecular form as glutamate neurons because it stimulates the central nervous system and the latter is the substrate resulting in glutamine, and by this the biomolecular gamma-aminobutyric acid (inhibitory neurotransmitter at the synapse level) is formed by the glutamic carboxylase enzyme. This neurotransmitter opens the chlorine channels, hyperpolarizes the postsynaptic membrane, and decreases neuronal activity.

It has been reported that only 1.8 kg of glutamate is found in the muscle tissue, brain, and kidneys. Due to its physicochemical characteristics, its degree of acidity (2.17 and 9.13) crosses the blood-brain barrier.

Glutamine can be produced from ammonia (NH_3) in the brain and is part of the detoxification process. For this reason, this biomolecule is part of the best-known antioxidants to maintain the function of various organic systems such as the immune system, the digestive system, and the muscular system.

Given the characteristics of this compound, it is included in the human diet in the form of a food supplement and in nutritional foods in the form of glutamine, since it allows the recovery of patients who have undergone surgery treatments and in cases of electrolyte loss in patients who have decreased their immunological system, for example, patients with AIDS or cancer.

This substance is also known as the chemical messenger, for its ability to interact with neurons and allow cell communication, as well as an energy source in oxidation processes of cancer cells [5].

This compound also participates in the metabolism of carbohydrates and in the cellular respiration process of the Krebs cycle [1].

This amino acid can cause alterations in patients who are treated with antiepileptic drugs or who suffer from kidney or liver disease, for which reason the dose of this amino acid must be controlled.

It is recommended to ingest glutamic acid by supplements. The nutrient presentations range from 200 to 500 mg, and for its intake, it is presented in solid pharmaceutical forms as tablets. The dose in pediatric patients from 6 to 12 years is 200 mg every 12 hour.

In patients with cancer who have been treated with chemotherapy and radiotherapy, the intake of glutamic acid benefits their recovery.

2.2 Omega-3 fatty acids

The omega-3 fatty acids include alpha-linolenic acid (ALA), eicosapentaenoic acid (EPA), and docosahexaenoic acid (DHA). The first is found in vegetable oils (flaxseed, soybeans, and canola), and the second and third are found in seafood and fish.

The fatty acids known as omega-3 refer to the position of the carbon atoms with respect to the carboxyl functional group (COOH). They are polyunsaturated fatty acids. The term omega is derived from the position of the terminal methyl functional group of the fatty acid as the main carbon atom identifying the double bond.

EPA and DHA are structural components of the phospholipids that are part of the membranes and are the substrates that give rise to eicosanoid lipids (derived from 20 carbon atoms such as EPA) and docosanoid lipids (derived from 22 carbon atoms such as DHA). The importance of these compounds lies in several functions of cellular metabolism. It has been reported that these fatty acids have anti-inflammatory properties that have a cytoprotective function.

In the men, the intake of this type of fatty acids increases in cell membranes, specifically in lymphocytes, decreasing the amount of arachidonic acid in cell membranes and decreasing the proinflammatory products of omega-6 fatty acids.

EPA is a substrate of the enzyme cyclooxygenase (COX-1–COX-2) and lipooxygenase-5 in the plasma membrane, competes with arachidonic acid (AA) in the production of eicosanoids, and maintains the levels of prostaglandins I_2 (inhibitor of platelet aggregation).

Dietary supplements based on EPA and DHA have the property of decreasing the production of proinflammatory cytokines such as interleukin-1, interleukin-6, interleukin-8, and pulmonary necrosis factor-alpha (TNF-alpha) released by activation of macrophages and monocytes. Although cytokines are activators of the immune response, the hyperactivity of the same can cause inflammation in the intestine, rheumatoid arthritis, and other inflammatory diseases. Therefore, dietary supplements based on EPA and DHA can decrease the production of inflammatory cytokines and the effects of TNF-alpha [6–8].

The documented mechanisms for the modulation of cytokines are based on the decrease of proinflammatory gene expression through changes in the activity of genetic transcription factors such as in the hyperactivation of receptors activated by PPAR-gamma peroxisomes and by inhibition in the release of the transcription nuclear factor-kB (NF-kB). Modification in the cell membrane related to cell signaling is also included.

Chemically, it is a carboxylic acid. It is found in fish oil and some seaweed. DHA is a polyunsaturated essential fatty acid of the omega-3 series [8]. The oil of unicellular algae is known as *Crypthecodinium cohnii* [9]. The omega fatty acid it is use for coronary disease and depression [7, 10] (**Figure 1**).

Also, DHA lowers blood pressure and prevents the development of hypertension and cardiovascular pathologies like atherosclerosis [11]. This substance has a strong positive relationship between dietary fat in the treatment of cancer. DHA inhibits cyclooxygenase, thereby decrementing the amount of prostaglandins and increasing the lipoxygenase activity. This in turn results in higher production of hydroxyeicosatetraenoic acids (HETE) and leukotriene B4 (LTB4), which have

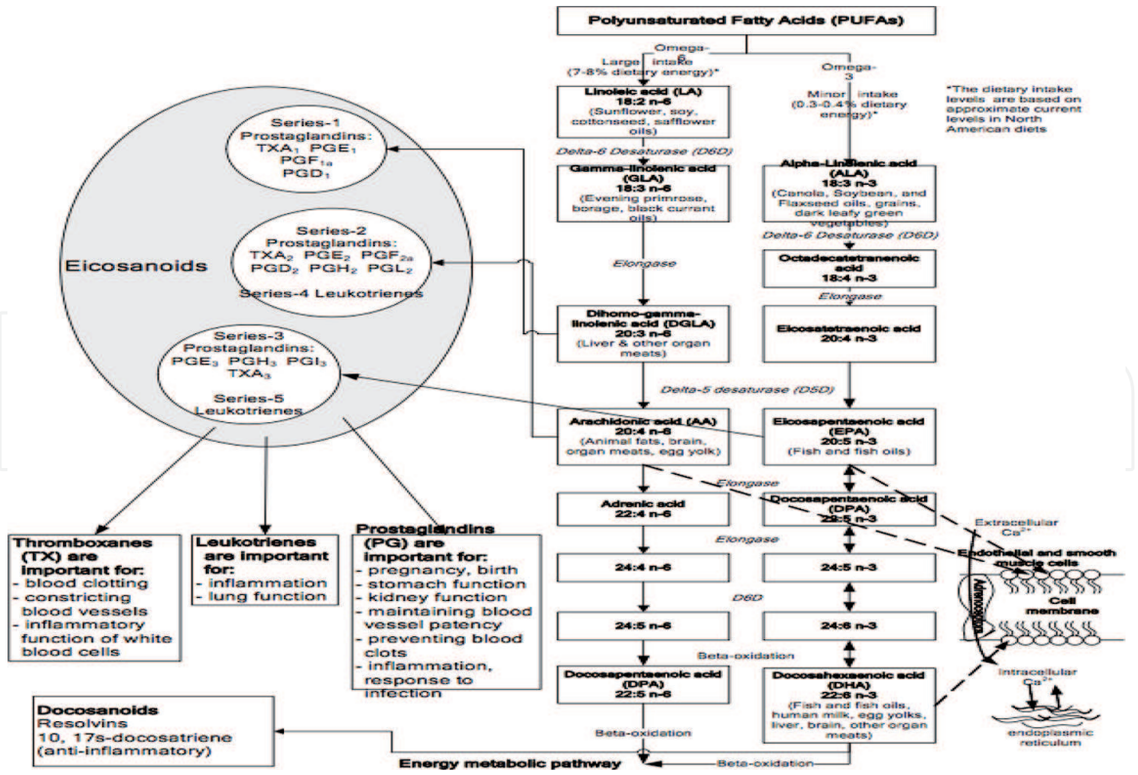


Figure 1.
Function of omega-3 fatty acid in regulating health markers and omega-3 and omega-6 fatty acid synthesis [7].

Names		Abbreviations		
Trivial	**IUPAC***	**Carboxyl-reference**	**Omega-reference**	**Other**
Linolenic acid	9,12,15-octadecenoic acid alpha-linolenic acid	$18{:}3\Delta^{9\,12\,15}$	18:3n-3 18:3 (ω-3)	ALA α-LA LNA α-LNA
Docosahexaenoic acid	4,8,12,15,19-docosahexaenoic acid cervonic acid	$22{:}6\Delta^{4\,8\,12\,15\,19}$	22:6n-3 22:6 (ω-3)	DHA
Docosapentaenoic acid	7,10,13,16,19-docosapentaenoic acid	$22{:}5\Delta^{7\,10\,13\,16\,19}$	22:5n-3 22:5 (ω-3)	DPA
Eicosapentaenoic acid Icosapentaenoic acid Timnodonic acid	5,8,11,14,17-eicosapentaenoic acid	$20{:}5\Delta^{5\,8\,11\,14\,17}$	20:5n-3 20:5 (ω-3)	

**IUPAC, International Union of Pure and Applied Chemistry. Trivial names, chemical names and abbreviations for the omega-3 fatty acids. Categorize according to their chain length of the polyunsaturated fatty acids (PUFAs) [7].*

Table 1.
Nomenclature of omega-3 fatty acids.

been suggested as retarding the process of cancerous cells taking over a tissue. In an experimental animal model, DHA act inhibiting transcription factor activator protein 1 (AP-1), which has been implicated in the development of cancer [12]. DHA could decrement the risk of neuropsychiatric disorders and could be attribute to their effect on neurotransmitter receptor and G-proteins via effects on the biophysical properties of cell membranes and secondary messengers, and on protein kinases [11, 13, 14]. The consumption of DHA can positively influence to avoid the deterioration caused by Alzheimer's (AD), associated with the production of amyloid beta

protein that make up hyperphosphorylated tau protein and ubiquitin. The disease is also related to the E4 allele of the apolipoprotein E (ApoE) gene found on the chromosome 19. The treatment for this disease is multiple and drug therapy is based on the stabilization of cognitive impairment and the behavior of the individual. As this disease is related to cholinergic function, the treatment is based on the intake of acetylcholinesterase inhibitor drugs. Therefore, the intake of omega-3 fatty acids is associated with the treatment of Alzheimer's due to its neuronal function [15]. **Table 1** shows the nomenclature of different omega-3 fatty acids [7].

3. Antioxidants

Antioxidants include vitamins A, C, and E and selenium.

3.1 Vitamin A

Carotene is a pigment that animals can turn into vitamin A in their body. C The intestine is the organ that is responsible for transforming carotene into vitamin A for storage in the liver and is rarely stored in fat tissue. Its common form is found as beta-carotene. Due to its chemical structure, it is part of the terpenes, formed by isoprene units (40 carbon atoms). The biosynthesis of these compounds is initially from isopentenyl pyrophosphate.

Beta-carotene was the first purified carotene (*Daucus carota*). Vitamin A is the active form of retinol. Milk and carrots, green vegetables, and some fruits are dietary sources of vitamin A. Isomerization reactions affect the vitamin A content.

Among its functions it is said that it protects the skin from the ultraviolet rays derived from the sun; it also keeps the immune system in optimal conditions, as well as the cardiac system, and is used as an antioxidant.

It is known that the oxidation process of low-density lipoprotein (LDL) decreases the risk of manifesting coronary diseases and arteriosclerosis.

With regard to cancer, it is said that vitamin A allows good cellular functioning by decreasing the development of cancer cells. The intake of this vitamin prevents colon, breast, lung, and oral cavity cancers.

Consumption of vitamin A allows the brain to function in good condition because it has been proven to delay cognitive aging and decrease the oxidative stress derived from the production of free radicals that can generate cell damage generating dementia.

With respect to respiratory diseases, the intake of carotenoids reduces the manifestation of respiratory disorders such as pulmonary emphysema, bronchitis, and asthma to keep the lungs in good condition.

These compounds prevent macular degeneration or loss of sight in adults. Among other things, it prevents skin aging due to its antioxidant properties, since it diminishes the effect of the ultraviolet light generated by the sun's rays and by environmental contamination.

One of the disadvantages due to the excessive use of this vitamin lies in the malformation of the fetus in pregnant women by high doses of carotene continuously.

The reactions that are carried out in the organism are oxidation, reduction, and esterification that give rise to different metabolic processes [16].

3.1.1 Oxidation

Retinol is the main form of vitamin A; it is a derivative of alcohols. In the eyes, vitamin A plays a fundamental role because it is part of the visual purple of the retina, and if the amount of vitamin A decreases, the ability to see is reduced.

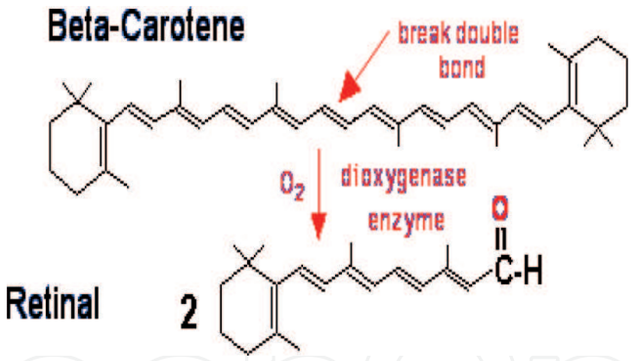


Figure 2.
Synthesis of retinal from beta carotene.

Beta-carotene is denatured in the walls of the intestinal mucosa where it interacts with the enzyme β-carotene desoxygenase to produce retinal (see **Figure 2**) [16].

3.1.2 Reduction reaction

The reduction reaction that vitamin A presents involves the passage from retinal to retinol in the presence of the enzyme retinaldehyde reductase in the intestine. The chemical reaction includes the reduction of an aldehyde by accepting hydrogen atoms to produce an alcohol known as retinol.

3.1.3 Esterification reaction

Retinoids are found in nature in the form of retinol (alcohol) and retinal (aldehyde). The three active forms of vitamin A in the body are retinol, the compound retinal, and retinoic acid. The compound retinal is metabolized in the body, producing retinoic acid and, by esterification reactions, retinol palmitate is produced which is part of the storage in the body.

The digestion of vitamin A is carried out as the degradation of fatty acids, that is, the retinol esters are hydrolyzed by the pancreatic lipase enzymes when they bind to the bile salts forming micelles where the free retinol is absorbed in the intestine specifically in the duodenum and jejunum. The absorption of retinoids is 80–90% and that of carotenoids is 30–40%.

In enterocytes or epithelial cells of the intestine, carotenoids and beta-carotene are attached to the chylomicrons and transported to the liver where they are stored as retinol palmitate. In hepatic cells, retinol binds to the retinol transporter protein (RBP) forming a conjugate by binding to prealbumin in order to travel over the bloodstream where it is transferred to other tissues. On the other hand, carotenoids travel to the bloodstream as part of very-low-density lipoproteins (VLDL) and are stored in adipose tissue.

In dietary supplements vitamin A reduces cancer risk [17].

3.2 Vitamin C

In 1920, Albert Szent-Györgyi, un bioquímico húngaro, identificó la vitamina C. Después, fue llamado ácido hexurónico por un médico llamado Joseph Svibely, Szent-Györgyi. Más tarde fue nombrado ácido ascórbico por Szent-Györgyi y Norman Haworth, un científico que también estudió la vitamina C [18]. Fue conocido desde su descubrimiento como factor de escorbuto. La vitamina C es un compuesto soluble en agua [19].

It is known as ascorbic acid; its chemical name is (R)-3,4,-dihydroxy-5-((S)-1,2-dihydroxyethyl) furan-2(%H)-one. In its oxidized form, it is known as dehydroascorbic acid ($C_6H_8O_6$).

As part of its functions, this compound is considered necessary for the organism since it participates in the growth and repair of tissues in the human body. It is important for the function of the skin, tendons, ligaments, and blood vessels. It is also important to heal wounds and tissues. It also participates in the repair and maintenance of the cartilage, bones, and teeth. Finally, it is important in the iron absorption process.

It presents oxidation and reduction reactions in the organism, since it gives hydronium ions to form L-dehydroascorbic acid.

Vitamin C is excreted in the small intestine (duodenum) and is passed into the bloodstream through a process of active transport of sodium ions. The process is saturable and dose-dependent. At high concentrations a part of the ascorbic acid is diffused by a simple diffusion process.

Its functions depend on the redox processes that is manifested in the interaction with other molecules [19]. Vitamin C functions as a cofactor in various hydroxylation and amination reactions by transferring electrons to enzyme complexes that produce reducing equivalents that facilitate the conversion of proline and lysine, which are amino acids that are part of procollagen in the form of hydroxyproline and hydroxylysine during synthesis of collagen. It also participates in the oxidation of the lysine side chains to form hydroxytrimethylisin in the synthesis of carnitine and in the conversion of folic acid into folinic acid. It is also an essential compound in the oxidation of amino acids such as phenylalanine and tyrosine and is important in the metabolism of tryptophan, and participates in the synthesis of noradrenaline [20].

It is considered an antioxidant agent because of its ability to capture free radicals such as H_2O_2, O_2^-, and hypochlorous acid [21].

Vitamin C prevents the oxidation of low-density lipoproteins (LDL) facilitating the absorption of iron [22]. In foods rich in vitamin C such as broccoli and cauliflower, it was shown that it has a correlation of phytochemicals (phenol, flavonoid, and glucosinolate) [23]. Another study highlighted the antioxidant capacity of vitamin C in fruits [24].

The physiological importance of vitamin C is its role as a cofactor and its participation in enzyme reduction reactions [22].

Vitamin C protects cell membranes, DNA [25], cellulose proteins and lipids against the oxidative effects of free radicals (ROS) [26, 27] and reactive oxygen species. At the immunological level, it stimulates phagocytosis and the formation of antibodies.

Adverse reactions to the consumption of this vitamin are rare, but care should be taken when dosing pregnant women. It can cause nausea, vomiting, acidity, abdominal cramps, fatigue, headache, insomnia, and drowsiness. Inappropriate consumption of vitamin C can cause arthritis [28].

In heroin addicts who present with oxidative stress, vitamin C levels [29, 30] can damage their health. Foods rich in potassium tend to be high in vitamin C; therefore, a decrease in potassium causes a decrease in vitamin C [31–34].

3.3 Alpha-tocopherol

Vitamin E is a substance with liposoluble characteristics and has been reported to have antioxidant properties. It is chemically presented with eight isoforms of vitamin E: four tocopherols (α, β, and δ) and four tocotrienols (α, β, and δ). It is found in foods such as wheat germ and sunflower, safflower, corn, and soybean oils.

It is absorbed in the small intestine and is passed into the bloodstream by transporting plasma lipoproteins. The serum vitamin E levels reported are from 11.6 to 46.4 μmol/L.

Vitamin E group includes all of the tocol and tocotrienol derivatives which qualitatively exhibit the biological activity of d-alpha-tocopherol. There are eight natural forms of vitamin E and they are divided into 2 fundamental groups: the 4 tocopherols (TF) and the 4 tocotrienols (TT) that differ in the saturation of the side chain; the tocopherols have a saturated chain and the tocotrienols an unsaturated with 3 double bonds. They are classified into alpha, beta, gamma and delta classes and derivatives of tocopherol and tocotrienol, which are synthesized by plants from homogentisic acid. Alpha and gamma-tocopherols are the two main forms of vitamin E. Vitamin E is known as alpha-tocopherol because it is the most abundant isoform in nature. It is absorbed in greater proportion in the gastrointestinal tract and is responsible for the activity in many metabolic processes.

The beneficial properties of alpha-tocopherol are manifested when the hydronium H^+ phenolic ion is transferred to a radical derived from polyunsaturated fatty acids.

It is the first line of defense against DNA oxidative damage and the peroxidation of polyunsaturated fatty acids in cell membranes.

It is found in many foods of vegetable origin such as nuts, hazelnuts, almonds, and pistachios and also in different food supplements. It has been proven that adverse reactions are minimal. Therefore, it is an excellent preventive compound of diseases and is part of the diet of man [35].

Currently it has been reported that tocopherols inhibit platelet aggregation by inhibiting protein kinase C (PKC) [36, 37] and increase the activity of nitric oxide synthase enzymes, the catalytic enzyme N-arginine and L-citrulline [38].

Alpha-tocopherol is used in inflammatory processes, in its inhibition of platelet aggregation, in the activity of the immune system, and in the reduction of cardiovascular complications (gamma-tocopherol) [39, 40].

In Alzheimer's disease (AD), amyloid beta protein is a substance involved in the cytotoxic processes due to peroxidation and the production of free radicals that produces cell death in the brain producing the symptoms of this disease. This is why vitamin E can act by blocking peroxide production and decreasing cytotoxic effects.

Alpha-tocopherol as an anti-inflammatory can decrease the discomfort caused in patients positive for the human immunodeficiency virus (HIV). Doses of 400 IU of alpha-tocopherol restore cutaneous hypersensitivity and interleukin-2 production, as well as increased proliferation of helper T cells (CD4 T cells) [41–45].

In the immune system, alpha-tocopherol increases the conditions of biological immunity in humans, the humoral and cellular immune response, and the phagocytosis process [46–49].

It is said that the antioxidant effect of vitamin E in combination with alpha-lipoic acid (AAL) enhances its antioxidant effect in cardiovascular and brain diseases [50].

3.4 Selenium

The selenium atom can be presented in different allotropic forms, in its vitreous and black form. When reduced it appears red. It has various uses, for example, for the treatment of seborrheic arthritis.

This element is found in foods like bread, cereals, fish, meat, lentils, potato peel, and eggs. It is found in conjugated amino acid molecules such as selenocysteine and selenomethionine, glutathione peroxidase enzymes (GSHPx), and thioredoxin reductase that have selenium in their chemical structure.

As an antioxidant it participates in the neutralization of free radicals in the process of the production of peroxides; it also induces apoptosis and is an agent

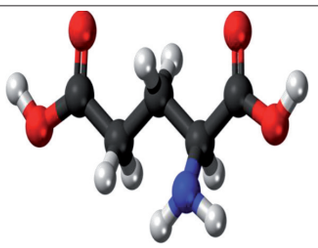
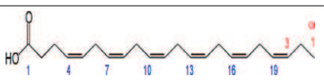
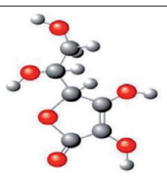
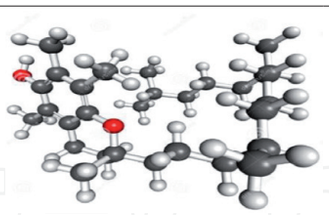
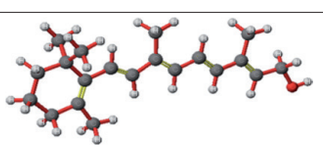
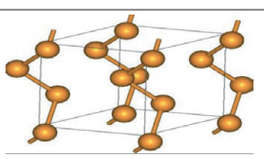
Antioxidant	Chemist structure	Function	Treatment
Glutamic ácid [$C_5H_9NO_4$] or glutamine		Is critical for cellular function and is not an essential nutrient because humans can synthesize it from other compounds. It is an acidic amino acids, or negatively charged at physiological pH, because it has a second carboxyl group in its secondary chain.	Contributes to trophism, since the small intestine is the body's main glutamine consumer, is the precursor of glutathione, a key molecule in the antioxidant chain, modulates the inflammatory response in different cells of the immune system and regulates cytokine production; protects cells from diverse insults, including heat shock proteins and apoptosis.
Docohexanoic acid [$C_{22}H_{32}O_2$]		The DHA is found at high concentrations in the phospholipids of neural cell membranes, where it serves several physiologic functions, including the regulation of membrane fluidity, the release of neurotransmitters, genetic expression, myelination, and cellular differentiation, and growth.	The consumption of DHA could prevent the deterioration caused by Alzheimer's.
Vitamin C		Relation as a cofactor and reduces certain enzymes by providing them with electrons.	Vitamin C decreases more quickly with increased oxidative stress, therefore, vitamin C is used to control oxidative stress.
Vitamin E		Vitamin E promotes membrane repair by preventing the formation of oxidized phospholipids that theoretically might interfere with the membrane fusion events.	Regulation of platelet, aggregation and protein kinase C activation, in disease prevention, cardiovascular diseases, cancer, cataracts, Alzheimer´s disease, human immunodeficiency virus and acquired immunodeficiency syndrome and the immunity.
β-carotene		Vitamin A has several functions in the body as the role in vision.	Decrement the risk of breast or lung cancer.
Selenium		Associated with an increase in glutathione peroxidase (GSHPx) activity.	Se, may inhibit lipid peroxidation in higher plants through GSH-Px and no enzymatic reactions.

Table 2.
Description of some antioxidants, chemist, structure, function and treatment.

that stimulates the immune system and participates in the proper functioning of the thyroid gland. Studies of this element indicate that it can prevent cancer by the chemoprotective action against oxidative stress. It is found in the form of selenite and selenate or as a conjugate derived from amino acids; the latter is beneficial for humans. It can be toxic at high doses causing the disease known as selenosis [51].

It is important in genetic engineering since the UGA termination codon serves as a codon for Se-cysteine and can be decoded by Se-cysteyl-tRNAs in herbs; so, this chemical element has specific biological functions. In **Table 2**, we show some antioxidants.

4. Polyphenols

Polyphenols are substances derived from plants with good absorption properties and bioavailability and are bioactive. They are classified into flavonoids, phenolic acids, stilbenes, lignans, and other derivatives.

According to the World Health Organization (WHO), diseases such as depression, diabetes, cardiovascular diseases, and cancer are caused by genetic inheritance, environment, and socioeconomic factors as causal agents in the development of these diseases.

Oxidative stress associated with certain diseases is part of epidemiological studies associated with a diet rich in antioxidants to reduce the effects caused by free radicals (ROS).

Antioxidants can be obtained from a diet rich in fruits and vegetables that include cocoa, coffee, and tea.

Studies related to polyphenols indicate beneficial effects on human health, since their consumption modifies absorption, bioavailability, and metabolism. Its antioxidant effect lies in the way of extracting plants and obtaining in some foods how potatoes improve microbial digestion in the colon due to the phenolic metabolites that are formed.

The antioxidant effects of polyphenols in the diet are attributed to the enzymatic regulation that reduce free radicals and modulate the enzymatic process during the development of cell reduction reactions.

Marmouzi et al. demonstrated that antioxidants form hybrids that prevent hyperglycemia via enzymatic modulation in phase II. The anticancer effect is also attributed to the signaling of cancer cells and to the progression of the cell cycle and modulation of apoptosis.

Derived polyphenols have antitumor effects in breast cancer with estrogen-mediated receptor activity (ERc) and with receptor 2 or epidermal growth factor (HER2) and in proliferation and chronic inflammation [50].

Degenerative disorder with Alzheimer's disease is related to human aging, and it has been observed that patients suffering from this disease have high levels of free radicals. The phenolic derivative resveratrol can inhibit the aggregation of the amyloid beta peptide, present in these patients. It is a phenol with antioxidant properties and anti-inflammatory that is involved with neuronal differentiation through activation as a silent regulator of cellular information.

Substances with important phytochemical properties used as antioxidants are curcumin, resveratrol, propolis, polyunsaturated fatty acids (PUFAS), and ginseng derivatives. They are used to decrease cerebral neuroinflammation. Avenanthramide is a substance that can serve as a therapeutic agent for the treatment of brain disorders.

The extracts of ethanol of *Diospyros kaki* rich in flavonoids diminish the oxidative stress and are mediators in the processes of inflammation and are related to the memory in synaptic processes in the communication of proteins.

On the other hand, the action of sulfhydryl (SH) and thiol groups in antistress processes is related to the enzymatic process of the carbonic anhydrase enzymes III and VII and the reactivity with amino acids such as cysteine and its residues in S-glutathionylation processes [52].

In Mediterranean countries diet rich in antioxidants including polyphenols has decreased coronary heart disease and cancer. The consumption of a diet rich in vegetables, fish oil, and olive oil and the consumption of wine and the reduction of saturated fats of the trans type have allowed to decrease cellular aging [53].

The diet based on polyphenols is included in the continents of Europe, Asia, and South America. The adherence and origin of polyphenols depend on the place of production [54].

5. Other causes of cancer

The presence of free radicals (ROS) can induce cell death in tissues and organs. The liver as an organ that metabolizes many substances as nutrients and drugs is the place most damaged by free radicals in parenchymal cells, mitochondria, and perixomes. ROS are related to fatty acid oxidation and gene expression.

The TNF-alpha cytokines can produce in Kupffer cells oxidative stress that give rise to inflammatory processes and apoptosis, which can cause liver damage and affect hemostasis, leading to irreversible damage to the synthesis of lipids, proteins, and DNA by the effect of modulators that control different biological functions.

The presence of ROS affects genetic regulation in the transcription process, in the expression of proteins, in apoptosis, and in cell activation, causing severe damage to metabolic processes leading to liver diseases such as chronic viral hepatitis and fatty liver caused by excess consumption of alcohol.

The clinical treatment derives from the consumption of antioxidants as adjuvants that can be synthetic products or derivatives of vitamins C and E and other substances such as mitoquinone, N-acetylcysteine, and silibinin for the treatment of chronic hepatitis C and for patients with cirrhosis [55].

Antioxidants such as zinc, coenzyme Q10, sylimarin, metadoxine, N-acetylcysteine, propofol and mitoquinone mesylate, selenium, methionine, and lipoic acid can be used in patients suffering from fatty liver and steatohepatitis. Methionine can also be used for liver treatment.

On the other hand, some foods induce the inhibition or inactivation of the P53 gene, which was known as the guardian of the genome, because of his function to identify and prevent the multiplication of cells with modified DNA in its structure due to carcinogenic people.

P53 is a transcription factor whose gene is located on the short arm of chromosome 17. P53 is a DNA repair sensor; if the damage is severe, P53 induces programmed cell death or apoptosis. If P53 has mutations, its functions are not carried out. If mutations occur in the germ line (gametic cells), it can lead to Li-Fraumeni syndrome, characterized by breast cancer and other neoplasms, which leads to a pattern of autosomal dominant transmission [56].

6. Conclusions

Therapy with antioxidants of synthetic origin and of natural origin is important for the treatment of different diseases including those derived from liver diseases. In the case of the use of plants, it is necessary to have knowledge of the

pharmacological studies of dosage effect, pharmacokinetics, and bioavailability of the compounds with antioxidant properties.

The inflammatory processes present in various pathologies such as cancer, intestinal inflammation, neurodegenerative diseases, cardiovascular diseases, asthma, and rheumatoid arthritis can be treated with omega-3 fatty acids in terms of prevention and treatment and with treatment of other antioxidants as selenium, polyphenols, and vitamins E and C.

In general for the treatment of cancer and other diseases that lead to the study of this disease, foods and supplements rich in antioxidants are a positive option that can be of preventive nature and can be used during the treatment of some anomaly derived from cancer and after the treatment with drugs and the application of radiations, since they favor the recovery of the patients.

Proper nutrition is very important to prevent certain diseases; for this reason, right consumption of nutrients and antioxidants and other substances such as probiotics and probiotics favors recovery in patients whose medical treatments have been aggressive, such as chemotherapies and radiotherapies in the treatment of cancer, diabetes, and hypertension, among others.

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References

[1] Serna-Thomé G, Castro-Eguiluz D, Fuchs-Tarlovsky V, Sánchez-López M, Delgado-Olivares L, Coronel-Martínez J, et al. Use of functional foods and oral supplements as adjuvants in cancer treatment. Revista de Investigación Clínica. 2018;**70**:136-146

[2] Coronado HM, Vega y León S, Gutiérrez TR, Vázquez FM, Radilla VC. Antioxidants: Present perspective for the human health. Revista Chilena de Nutricion. 2015, 2015;**42**(2):206-212

[3] Ríos Hernández MA, Hernández Menéndez M. Los genes supresores de tumores y el cáncer. Revista Cubana de Oncología. 2001;**17**(1):65-71

[4] Cederholm T, Barazzoni R, Austin P, et al. ESPEN guidelines on definitions and terminology of clinical nutrition. Clinical Nutrition. 2017;**36**:49-64

[5] Kucuktulu E, Guner A, Kahraman I, Topbas M, Kucuktulu U. The protective effects of glutamine on radiation-induced diarrhea. Supportive Care in Cancer. 2013;**21**:1071-1075

[6] Meydani M. Protective role of dietary vitamin E on oxidative stress in aging. Age. 1992;**15**(3):89-93

[7] MacLean CH, Issa AM, Newberry SJ, Mojica WA, Morton SC, Garland RH, et al. Effects of omega-3 fatty acids on cognitive function with aging, dementia, and neurological diseases. Evidence report/technology assessment. Agency for Healthcare Research and Quality. 2005;**114**:1-88

[8] Valenzuela BR, Tapía OG, González EM, Valenzuela BA. Omega-3 fatty acids (EPA and DHA) and its application in diverse clinical situations. Revista Chilena de Nutricion. 2011;**38**(3):356-367

[9] Calder R. Docosahexaenoic acid. Advances in Nutrition. 2016;**7**:1139-1141

[10] Mendes A, Reis A, Vasconcelos R, Guerra P, Lopes da Silva T. Crypthecodinium cohnii with emphasis on DHA production: A review. Journal of Applied Phycology. 2009;**21**:199-214. DOI: 10.1007/s10811-008-9351-3

[11] Joordens JCA, Kuipers RS, Muskief FAJ. Performed dietary DHA: The answer to a scientific question may in practice become translated to its opposite. American Journal of Human Biology. 2007;**19**:582-584. DOI: 10.1002/ajhb.20675

[12] Narayan B, Miyashita K, Hosakawa M. Physiological effects of eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA): A review. Food Review International. 2006;**22**:291-307. DOI: 10.1080/87559120600694622

[13] Liu G, Bibus DM, Bode AM, Ma WY, Holman RT, Dong Z. ω-3 but not polyunsaturated fat content of canned meats commonly available in Australia. Food Australia. 2001;**54**:311-315

[14] Hibbeln JR, Salem JN. Dietary polyunsaturated fatty acids and depression: When cholesterol does not satisfy. The American Journal of Clinical Nutrition. 1995;**62**:1-9

[15] Edwards RH, Peet M. Essential fatty acid intake in relation to depression. In: Peet M, Glennm I, Horrobin DF, editors. Phospholipid Spectrum Disorder in Psychiatry. Lancashire: Marius Press; 1999. p 211

[16] Waitzberg DL, Garla P. Contribución delos ácidosgrasosomega-3 para la memoriay la función cognitiva. Nutrición Hospitalaria. 2014;**30**(3):467-477

[17] Engel P, Wyss A. Vitamin A. 2017. Available from: http://www.nutri-facts.org/content/dam/nutrifacts/

pdf/Nutrients-pdf/Vitamin-A-v2.pdf [Accessed: December 19, 2018]

[18] Grzybowski A, Pietrzak K. Albert Szent-Györgyi (1893-1986). The scientist who discovered vitamin C. Clinics in Dermatology. 2013;**31**(3):327-331

[19] Gallie DR. Increasing vitamin C content in plant foods to improve their nutritional value successes and challenges. Nutrients. 2013;**5**:3424-3446

[20] Mandl J, Szarka A, Bánhegyi G. Vitamin C: Update on physiology and pharmacology. British Journal of Pharmacology. 2009;**157**:1097-1110

[21] Chatterjee IB. Evolution and the biosynthesis of ascorbic acid. Science. 1973;**182**:1271-1272

[22] Doll S, Ricou B. Severe vitamin C deficiency in a critically ill adult: A case report. European Journal of Clinical Nutrition. 2013;**67**:881-882

[23] Young IS, Woodside JV. Antioxidants in heath and disease. Journal of Clinical Pathology. 2001;**54**:176-186

[24] Padayatty SJ, Levine M. New insights into the physiology and pharmacology of vitamin C. Canadian Medical Association Journal. 2001;**164**(3):353-355

[25] Bhandari SR, Kwak JH. Chemical composition and antioxidant activity in different tissues of brassica vegetables. Molecules. 2015;**20**(1):1228-1243

[26] Kou X, Chen Q, Li X, Li M, Kan C, Chen B, et al. Quantitative assessment of bioactive compounds and the antioxidant activity of 15 jujube cultivars. Food Chemistry. 2015;**173**:1037-1044

[27] Padayatty SJ, Katz A, Wang Y, Eck P, Kwon O, Lee JH, et al. Vitamin C as an antioxidant: Evaluation of its role in disease prevention. Journal of the American College of Nutrition. 2003;**22**(1):18-35

[28] Wang Y, Russo TA, Kwon O, Chanock S, Rumsey SC, Levine M. Ascorbate recycling in human neutrophils: Induction by bacteria. Proceedings of the National Academy of Sciences of the United States of America. 1997;**94**(25):13816-13819

[29] Traber MG, Stevens JF. Vitamins C and E: Beneficial effects from a mechanistic perspective. Free Radical Biology & Medicine. 2011;**51**(5):1000-1013

[30] Sharkey JR, Branch LG, Zohoori N, Giuliani C, Busby-Whitehead J, Haines PS. Inadequate nutrient intakes among homebound elderly and their correlation with individual characteristics and health-related factors. The American Journal of Clinical Nutrition. 2002;**76**(6):1435-1445

[31] Hsiao PY, Mitchell DC, Coffman DL, Allman RM, Locher JL, Sawyer P, et al. Dietary patterns and diet quality among diverse older adults: The University of Alabama at Birmingham Study of Aging. The Journal of Nutrition, Health & Aging. 2013;**17**(1):19-25

[32] Zhou JF, Yan XF, Ruan ZR, Peng FY, Cai D, Yuan H, et al. Heroin abuse and nitric oxide, oxidation, peroxidation, lipoperoxidation. Biomedical and Environmental Sciences. 2000;**13**(2):131-139

[33] Morena M, Cristol J-P, Bosc J-Y, Tetta C, Forret G, Leger C-L, et al. Convective and diffusive losses of vitamin C during haemodiafiltration session: A contributive factor to oxidative stress in haemodialysis patients. Nephrology, Dialysis, Transplantation. 2002;**17**(3):422-427

[34] Pacier C, Martirosyan DM. Vitamin C: Optimal dosages, supplementation

and use in use in disease prevention. Functional Foods in Health and Disease. 2015;**5**(3):89-107

[35] Di Mascio P, Murphy ME, Sies H. Antioxidant defense systems: The role of carotenoids, tocopherols, and thiols. The American Journal of Clinical Nutrition. 1991;**53**:194S-200S

[36] Freedman JE, Farhat JH, Loscalzo J, Keaney JF Jr. Alpha-tocopherol inhibits aggregation of human platelets by a protein kinase C-dependent mechanism. Circulation. 1996;**94**:2434-2440

[37] Li D, Saldeen T, Romeo F, Mehta JL. Different isoforms of tocopherols enhance nitric oxide synthase phosphorylation and inhibit human platelet aggregation and lipid peroxidation: Implications in therapy with vitamin E. Journal of Cardiovascular Pharmacology and Therapeutics. 2001;**6**:155-161

[38] Brigelius-Flohé R, Traber MG. Vitamin E: Function and metabolism. The FASEB Journa. 1999;**13**:1145-1155

[39] Liu M, Wallmon A, Olsson-Mortlock C, Wallin R, Saldeen T. Mixed tocopherols inhibit platelet aggregation in humans: Potential mechanisms. The American Journal of Clinical Nutrition. 2003;**77**:700-706

[40] Steinberg D, Parthasarathy S, Carew TE, Khoo JC, Witztum JL. Beyond cholesterol: Modifications of low-density lipoprotein that increase its artherogenicity. The New England Journal of Medicine. 1989;**320**:915-924

[41] McAnally JA, Gupta J, Sodhani S, Bravo L, Mo H. Tocotrienols potentiate lovastatin-mediated growth suppression in vitro and in vivo. Experimental Biology and Medicine (Maywood, N.J.). 2007;**232**:523-531

[42] Sesso HD, Buring JE, Christen WG, Kurth T, Belanger C, MacFadyen J, et al. Vitamins E and C in the prevention of cardiovascular disease in men: The Physicians' Health Study II randomized controlled trial. Journal of the American Medical Association. 2008;**300**:2123-2133

[43] Stone WL, Krishnan K, Campbell SE, Qui M, Whaley SG, Yang H. Tocopherols and the treatment of colon cancer. Annals of the New York Academy of Sciences. 2004;**1031**:223-233

[44] Wells SR, Jennings MH, Rome C, Hadjivassiliou V, Papas KA, Alexander JS. Alpha-, gamma- and delta-tocopherols reduce inflammatory angiogenesis in human microvascular endothelial cells. The Journal of Nutritional Biochemistry. 2010;**21**:589-597

[45] Wada S. Chemoprevention of tocotrienols: The mechanism of antiproliferative effects. Forum of Nutrition. 2009;**61**:204-216

[46] Jiang Q, Wong J, Fyrst H, Saba JD, Ames BN. Gamma-tocopherol or combinations of vitamin E forms induce cell death in human prostate cancer cells by interrupting sphingolipid synthesis. Proceedings of the National Academy of Sciences of the United States of America. 2004;**101**:17825-17830

[47] Ganser A, Greher J, Volkers B, Staszewski A, Hoelzer D. Azidothymidine in the treatment of ATDS. The New England Journal of Medicine. 1988;**318**:250-251

[48] Kono N, Ohto U, Hiramatsu T, Urabe M, Uchida Y, Satow Y, et al. Impaired a TTP-PIPs interaction underlies familial vitamin E deficiency. Science. 2013;**340**:1106-1110

[49] Saliha R, Syed TR, Faizal A, Absar A, Shania A, Farzana M. The role of vitamin E in human and some diseases. SQU Medical Journal. 2014;**14**(2):e157-e165

[50] González PO, Moy NA, Gúzman MJ. El alfa tocoferol y el ácido alfa-lipoico. Una sinergía antioxidante con potencial en medicina preventiva. Revista de investigación clínica. 2008;**60**(1):5867

[51] Hartikainen H, Xue T, Piironen V. Selenium as an anti-oxidant and pro-oxidant in ryegrass. Plant and Soil. 2000;**225**:193-200

[52] Grosso G. Dietary antioxidants and prevention of non-communicable diseases. Antioxidants. 2018;**7**:94. Available from: www.mdpi.com/journal/antioxidants

[53] Monti DM, Rigano M, Monti S, Peixoto HS. Role of Antioxidants in the protection from Aging-related diseases. Oxidative Medicine and Cellular Longevity. Hindawi. 2018;**2019**:1-2

[54] Godos J, Rapisarda G, Marventano S, Galvano F, Mistretta A, Grosso G. Association between polyphenol intake and adherence to the Mediterranean diet in Sicily, Southern Italy. Nepal Forum of Science Journal. 2017:1-7

[55] Li S, Tan HY, Wang N, Zhang ZJ, Lao L, Wong CHW, et al. The role of oxidative stress and antioxidants in liver diseases. International Journal of Molecular Sciences. 2015;**16**:26087-26124

[56] Salamanca GF. Células troncales, cancer y P53. Gaceta medica de Mexico. 2009;**145**(5):441-442