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Whey We Extend the Food Shelf Life by Aid of Natural Antioxidants?

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ABSTRACT

The Meat products are highly nutritious foods, as they are sources of proteins, fats, vitamins, and minerals. Due to their chemical characteristics and modifications resulting from processing, the meat products are very susceptible to oxidation and microbial contamination, which justifies the use of various food additives, such as antioxidants and preservatives, represented mainly by synthetic compounds whose consumption is related to several health risk factors. Therefore, there is an urgent need to replace these substances, and bioactive phytochemicals appear as a promising alternative. In this chapter, we discuss various aspects related to the use of natural antioxidants in the meat products, comprehending the chemical composition of the meat and its derivatives, their oxidative processes, the toxic compounds due to oxidation, the use of natural antioxidants, and the other observed effects of isolated compounds, extracts, and essential oils, such as the antimicrobial activity, demonstrating their potential in reducing the use of the synthetic food additives.

Keywords: Meat Products; Chemical Characteristics; Oxidation; Microbial Contamination

Abbreviations: ROS: Reactive Oxygen Species; RNS: Reactive Nitrogen Species; RSS: Reactive Sulfur Species; BHA: Butylated Hydroxyanisole; BHT: Butylated Hydroxytoluene; CND: Chronic Noncommunicable Diseases; LDL: Low-Density Protein; COP: Cholesterol Oxidation Products

Introduction

The Meat products are the foods obtained through the processing of the fresh meat from different animals through one or more types of processes such as the fractionation, cooking, drying, salting, smoking, fermentation, and the addition of condiments, seasonings, or other food additives. The processing of the fresh meat may reduce their perishability and increase their shelf life, minimize costs with transport and storage, as well as add value to the waste (the shavings, the tendons, the fat, etc.) and to less valued cuts or the ones that generally would not be consumed in their fresh state, generating alternatives for their commercialization. The processing of the meat does not have a significant impact on their nutritional quality; however, it gives characteristics such as color, flavor, and aroma that are typical of each process employed. Processing can contribute to the occurrence of oxidative processes because it involves a high level of the manipulation. Oxidation affects attributes such as flavor, color, texture, and nutritional value, due to the attack of free radicals on lipids, pigments, proteins, and vitamins, being a limiting factor in the quality and acceptability of the meat and the meat products.

The Various artificial food additives with antioxidant function are used in the meat products to avoid undesirable changes in their sensory and the nutritional attributes. However, due to the risks that their high consumption can offer such as the development of the neoplasms, the allergies, and the other manifestations of the toxicity, the search for the natural alternatives in the food industry is growing. The use of the natural antioxidants in the meat products is as an alternative to synthetic food additives. The Most sources of the natural antioxidant compounds have shown to be potentially safer, since they have been widely consumed by the general population and have not shown signs of the toxicity, and they also provide beneficial functional activities to the human health. For better understanding of the oxidative processes in the meat products and how the natural antioxidants can be used for prevention, this chapter will present the various oxidation mechanisms, types of antioxidant activity, and studies related to the use of the natural antioxidants directly in the formulation as well as in active packaging used in the meat products [1-7].

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The Composition and the Chemical Characteristics of the Meat

The Meat is a food that has great importance in the human nutrition for its high protein content, the presence of the essential fatty acids and the B vitamins, such as the vitamin B12 and the cobalamin, found essentially in the products of animal origin, in addition to minerals such as iron and zinc. The Water is the main component of the meat, which directly influences its quality, juiciness, texture, color, and flavor. Regardless of age, race, sex, and region of production, the meat is a source of protein of high biological value, since the amino acids present in the meat are essential for the human needs, provided in adequate quantity and variety. Fat is a determining factor of quality, as it influences sensory properties, such as palatability, and the nutritional value. However, fat is also primarily responsible for the oxidative process in the meat products [8-15].

The Oxidative Processes in the Meat and the Meat Products

The Meat processing generally involves a high level of manipulation, often with a great fractionation of the meat, which can contribute to the occurrence of oxidative processes, either by the decompartmentalization of cellular structures, which allows the interaction of previously isolated compounds, or by exposure of these molecules to oxygen and light, which contributes to the formation of free radicals and the spread of oxidative reactions. Several factors can affect oxidation in the meat products, such as the content of vitamin E (α-tocopherol), pro-oxidizing agents, such as copper and free iron found in muscles, and free radicals which are also fundamental in preventing, delaying, or promoting oxidative processes in the meat.

Free radicals, which are highly unstable and active for chemical reactions with other molecules, are derived from the following elements: oxygen, nitrogen, and sulfur, generating reactive oxygen species (ROS), reactive nitrogen species (RNS), and reactive sulfur species (RSS). The free radicals in the meat products attack mainly lipids, proteins, and pigments, which will be discussed in more detail below. The Oxidation is responsible for the loss of quality in the various foods, promoting changes in color, texture, flavor, and aroma, causing nutritional losses of the lipids, the proteins, and the pigments, in addition to producing several potentially toxic compounds. Lipid oxidation is the most studied one due to the significant quality loss generated by it, but the oxidation of the other compounds cannot be neglected. It shows a summary of the changes caused by the oxidation of the meat products and the effects on their quality [16-23].

The Lipid Peroxidation

Lipid oxidation reduces the quality and acceptability of the meat and the meat products. It affects the taste, aroma, color, texture, and nutritional value of product, promoting the development of undesirable flavors (off-flavors), discoloration, the production of potentially toxic substances, such as malonaldehyde and cholesterol oxides, and also reduces in the nutritional value due to the decomposition of antioxidant fat-soluble vitamins and essential fatty acids. The Lipoperoxidation in the meats and the meat products is influenced by several factors, with emphasis on the composition of fatty acids, especially polyunsaturated ones in cell membrane phospholipids, which are the main targets of oxidative rancidity. The photooxidation and self-oxidation processes, characteristic of lipid peroxidation, involve initiation, propagation, and termination phases. The onset comes from the interaction of a radical with oxygen, which, once activated, can react with the unsaturated fatty acid, removing a hydrogen atom from the methylene carbon adjacent to the cis double bond of the unsaturated fatty acid, forming radicals [24-31]. Propagation occurs by reaction of free radicals of fatty acids with oxygen, with the formation of peroxide and hydroperoxide radicals, which are tasteless and odorless.

The Heat catalyzation by the metal ion or the photosensitizers and the light can cause the decomposition of hydroperoxide, resulting in secondary products responsible for the odor, flavor, and texture characteristic of rancidity. Once started, the reaction follows the chain and only ends when the reserves of unsaturated fatty acids and oxygen are exhausted. With the depletion of substrates, the propagation reactions cease and the termination begins, characterized by the formation of stable or nonreactive end products, which comprise the derivatives of the decomposition of the hydroperoxides, such as alcohols, aldehydes, ketones, esters, and other hydrocarbons. The Free radicals and most lipid oxidation products, such as malonaldehydes and cholesterol oxidation products present in rancid products, have attracted the attention of the scientific community, as they are toxic to cells and possibly have a relationship with the development of diseases with known and unknown etiology, such as: the carcinogenesis , the atherosclerosis , the organ ischemia , the rheumatoid arthritis , the Alzheimer's and the Parkinson's disease , the gastrointestinal disorders , and with the aging [32-39].

The Protein Oxidation

The oxidative modification of proteins can happen through the oxidative modification of a specific amino acid, by peptide cleavage mediated by free radicals or by the formation of complexes resulting from the binding of the protein with lipid peroxidation products. The Amino acids such as the methionine, the cysteine, arginine, and the histidine seem to make proteins more vulnerable to the oxidation, and their modifications mediated by the free radicals increase the susceptibility to the enzymatic proteolysis. The Protein products damaged by oxidation can contain reactive groups that contribute to damaging the membrane and many cellular functions. A peroxide radical is generally considered to be a species of the free radical involved in the oxidation of the proteins. The ROS can generate the carbonyls, the methionine sulfoxide, and the peroxides, and the oxidative damage promoted in the protein-rich products such as the meat can affect the enzyme activity, receptors, and the membrane transport directly related to the meat maturation process, the heat stability, and increasing the susceptibility to the proteolysis [40-48].

The Oxidation of the Pigments

The color of the meat is defined by the content and shape of myoglobin, a protein present in muscle cells that is responsible for the transport and storage of oxygen. This metalloprotein has a polypeptide chain linked to a prosthetic group, formed by a porphyrin ring containing an iron atom, called heme group. The iron contained in the heme group binds to oxygen and can take various forms, which are reversible with each other. Depending on the oxidation state of the iron contained in its molecule, the color of myoglobin can change considerably. The Myoglobin can be presented in a reduced form called deoxymyoglobin, which is purple red in color, characteristic of the fresh meat cuts or the ones subjected to low oxygen pressures, as in the vacuum-packed meat. When subjecting the meat to high concentrations of oxygen, the iron in the myoglobin molecule keeps its reduced form (Fe+2), now linked to oxygen, changing its color to bright red, and the protein is now called oxymyoglobin. When the iron in the myoglobin is in its oxidized state (Fe+3), the protein starts to have a brown color, and it is called metmyoglobin [49-56].

The Antioxidants Used in the Meat Products

The antioxidant compounds act in the inhibition of the oxidation of nucleic acids, proteins, pigments, and, mainly, lipids, and are classified in two broad categories, chain-breaking antioxidants, which act in the radical propagation stage (such as phenols and aromatic amines) and preventive antioxidants, which act in the initiation stage of the radical process (such as the enzymes peroxidase and catalase). Currently, the most used classification for antioxidants subdivides them into the primary, the synergists, the oxygen removers, the biologicals, chelating agents, and the mixed antioxidants [57-63].

The Synthetic Antioxidants and Toxicity

The Ultra-processed foods are industrial formulations manufactured entirely or mostly from substances extracted from the food. They are mixtures of ingredients from the different foodstuffs, in order to create products accessible, palatable, durable, convenient, and ready for consumption or that only need heating to be consumed, prepared through processes such as cooking, frying, and making use of the food additives, as well as the addition of the salting, vitamins and minerals, preserves, and sophisticated forms of packaging. Examples of the ultra-processed meat are pre-prepared dishes of poultry, fish, and beef, such as nuggets, bologna, sausages, pates, hamburgers, as well as canned, preserved, the smoked meat, cured fish, and canned fish in oil, among others. Since they are chemicals that are purposely added to the food, it is essential to know the properties of the antioxidant food additives used in these meat products, as their consumption can have toxic effects. Thus, it is essential to know the maximum permitted levels of addition of antioxidants. Such substances can have adverse health effects when not used within the established safety limits [64-70].

The antioxidants butylated hydroxyanisole (BHA) and butylated hydroxytoluene (BHT), can cause damage and mutations in the DNA, triggering the appearance of neoplasms. Besides that, they increase the content of lipids and blood cholesterol, increasing the liver formation of the enzymes for their metabolism, with the associated risk of destruction of important compounds, such as the vitamin D. These compounds can also act as inducers of the urticaria and the eczematous dermatitis. The Nitrite, widely used as a healing salt, when ingested in excess can interact with the amines and the amides, giving rise to the N-nitrous compounds such as the nitrosamines which are mutagenic, teratogenic, and carcinogenic agents. The high consumption of sausages is directly related to the development of cancer, mainly of the stomach and intestine. The excessive intake of propyl gallate can generate adverse reactions such as the allergic reactions and the gastric irritations, as the hives and the rhinitis, the changes in the vision, and the respiratory problems. Such the evidence indicates the importance to replace the artificial food additives with natural ones [71-77].

The Natural Antioxidants and the Possibilities of the Use in the Meat Products

The consumption of the ultra-processed foods has contributed to an epidemiological and nutritional transition observed in recent decades worldwide, characterized by a significant increase in the occurrence of the Chronic Noncommunicable Diseases (CND), such as the cardiovascular diseases (the infarction, the cerebrovascular accident, the systemic arterial hypertension), the metabolic, and the neoplasms. The population's greater access to information on the mechanisms of association of these diseases with the eating habits has led to the growth of a market niche that seeks more natural and healthier foods. Despite this, the consumption of the ultra-processed foods cannot be neglected, since they have the advantage of a great practicality of preparation and consumption, in addition to their long shelf life and almost complete use of food, reducing waste. The use of the natural food additives in the ultra-processed foods can be a viable alternative, inhibiting the oxidation of the lipids, the proteins, and the pigments, the preserving attributes such as the color, the texture, the aroma, the flavor, and the overall quality of the product.

The Natural antioxidants can be used directly in the formulation of the various types of the meat products, including ultra-processed ones, without generating losses in the quality and the shelf life, causing effects that are comparable to the synthetic antioxidants. In addition, the natural antioxidants can also be added in active packaging, which has several advantages, such as the reduced amount of active substance in the product, as they are released in a controlled manner over time, increasing consumer safety. In this case, due to the fact that these compounds are not directly added to the product, their interaction with the various components of the food is reduced, which is an advantage since some antioxidant agents added to the food may partially lose their activity due to its interaction with other components

of the product. The use of the extracts of the spices, the fruits, and the vegetable residues as the antioxidants in the meat products. The natural antioxidants were used directly in the meat products or in their packaging, highlighting the plant species from which the extract was obtained, its concentration, the meat product in which it was applied and the main results found [78-83].

The Natural Antioxidants and the Reduction of the Toxic Substances Produced by the Oxidation in the Meat Products

The Malonaldehyde (MDA)

The Malonaldehyde (MDA) is a short-chain aldehyde formed by the decomposition of lipid hydroperoxides and their concentration has been used to verify the intensity of lipid peroxidation in food and biological systems. MDA is the secondary product of lipid oxidation that contributes to the reduction of the quality of the meat product. It is suggested that reactive aldehydes generated endogenously during the lipid peroxidation are associated with oxidative lipid modification. The oxidative degradation generated by the products of the oxidative chain together with malonaldehydes generates oxidation of fatty acids from the membranes of the meat cells, promoting physical-chemical changes that result in dysfunctions of the cell membrane. Reactive aldehydes, such as MDA, stay reactive for longer than free radicals and can react with biological substances, as proteins, RNA, DNA, which become mutagenic, indicating the need to control their formation. A relationship between atherosclerosis and peroxidized lipid products has been reported in some studies, which involves the prevention of lipid oxidation in blood plasma (low-density protein-LDL), using antioxidants such as vitamins and phenolic compounds. The use of antioxidant-rich spices can also reduce MDA in the meat products, such as hamburgers and the dried meat, indicating that the functionality of these spices goes far beyond the sensory characteristics, such as the adding color, the aroma, and the flavor. The use of the spices was considered capable of reducing the level of MDA in the processing of a traditional meat product (dendeng), made from the dried meat. This meat is commonly produced using sugar and some spices, such as coriander, garlic, galangal, pepper, tamarind, cinnamon, cumin, and lemon. In the study, garlic and coriander were added in a concentration higher than usual (between 5% and 10% and 1–2%, respectively), and it was found that the reduction in the level of MDA was caused by the decrease in the intensity of the oxidation reaction [84-89].

The Cholesterol Oxidation Products (COP)

Cholesterol oxidation products (COP) are formed from cholesterol during processing and storage of high-fat foods, such as the meat products, mainly under heat treatment in the presence of oxygen and light. In vivo, these products can be originated either by endogenous production or by consumption through the diet. The most common COP in foods are 7a-hydroxycholesterol (7a-OH), 7b-hydroxycholesterol (7b-OH), 5,6a-epoxycholesterol (5,6a-EP), 5,6b-epoxycholesterol (5,6b-EP), 5a-cholestane-3b, 5-cholesten-3b-25-diol (25-OH), 5,6b-triol (triol), and 7-ketocholesterol (7-keto). The process of formation during heating is similar to the process of lipid oxidation, which involves reaction of free radicals, formation, and degradation of hydroperoxide. The presence of COP has been reported in several meat products, such as the beef, the ham, the meat for children, different types of the processed meats, fish products, and seafood [66], and the number and variety of COP formed in the products depends, mainly, on processing conditions and the meat fat content. Types of COP in the meat-based baby foods, indicating a strong direct and indirect development of oxidized cholesterol. The COPs (7-keto) in the dry hams. The formation of COP in the processed meat such as the meat patties, the braised meat, and the meat fillets.

Since the cholesterol is present in a variety of types of the food, mainly the meat products which are rich in the fat, the thermal oxidation, the photooxidation, and the auto-oxidation can occur, compromising the food safety and the human health. In this sense, the development of the COP has been related to possible harmful effects to the human health, and its excessive consumption can lead to oxidative DNA damage, the appearance of several cardiac, neurovascular, neurodegenerative, and mutagenic diseases with carcinogenic effects. The COP are known for the greater deleterious effect on arterial cells than on pure cholesterol and are also closely related to negative biological factors in living organisms. The COP have the ability to inhibit the cell proliferation, to induce apoptosis of vascular tissue cells, and to associate themselves with high-density lipoprotein (LDL) particles, especially in the hypercholesterolemic patients, contributing to the uptake of the LDL by endothelial receptors, leading to its accumulation in the artery wall .Thus, it is necessary to minimize the formation of the COP in the meat products during processing and storing in order to make them safer. The use of antioxidants has been reported as an excellent alternative to prevent oxidative damage caused by free radicals and to inhibit lipid oxidation in food systems. The use of natural antioxidants has been a good strategy to prevent the oxidation of sterols, since research on these compounds and their use in industry has increased, given that their activity is similar or even higher than that of synthetic antioxidants as well as being safer.

Promising results have been reported in model systems, using direct application of the antioxidants, the tocopherol, the green tea catechins, the conjugated linoleic acid, the rosemary extracts, and quercetin, among others. The antioxidant effect of the aqueous extract of the Melissa officinalis on the degradation of the cholesterol and the formation of the COP during heating in beef patties. The M. officinalis extract was able to protect cholesterol from thermal degradation, producing reduced levels of COP throughout the heating process. The foods (pork and eggs) may also be susceptible to the formation of the COP during the prolonged heating. The various antioxidants (the vitamin C, the vitamin E, the BHA, and the trolox) effect on the inhibition of the COP in the food. The antioxidants are effective in inhibiting the formation of the COP, when used in the appropriate concentrations, to

avoid the pro-oxidant effect. The consumption of the natural antioxidants is also important to avoid the harmful effects of the COP in vivo. The Supplementation of the isoflavone in the animal diets reduced the COP for the activating the hepatic cholesterol 7a-hydroxylase and by reducing the plasma COP levels, with the fecal excretion of the bile acids, in addition to suppressing the oxidative stress [90-97].

The N-Nitrosamines and the N-Nitrosamides

The indiscriminate use of synthetic food additives in the meat products industry, such as nitrites and nitrates, due to the need to increase the useful life, prevent the proliferation of microorganisms and inhibit the development of their toxins, promotes the formation of substances hazardous to the human health, being potentially carcinogenic, mutagenic, and teratogenic, such as N-nitrosamines and N-nitrosamides . Sodium nitrate and nitrite can be used as meat curing agents and they can form the intermediate nitrosating agents N2O3, NO, and NO2. Reactive NO reacts with myoglobin, producing the nitrosylmyoglobin that generates the typical of red color of the cured meat. The Nitrosating agents can react with secondary and tertiary amines and forming carcinogenic compounds. However, the reactivity of these agents can be avoided by stabilizing N2O3 using antioxidants, such as natural antioxidants. These natural antioxidants added together with nitrite to the meat can prevent the formation of the undesirable nitrous anhydride (N2O3, the main nitrosating agent). The N-nitrosamines are N-nitrous, aliphatic, or aromatic compounds that have a nitrous functional group attached to a nitrogen atom, while N-nitrosamides have a carbonyl group.

The physicochemical properties depend on the radicals attached to the nitrogen atom, and can be found in solid, liquid, or gaseous forms, which can be synthesized from nitrous acid and secondary amines . In general, N-nitrosamines are stable in neutral or strongly basic media, and are difficult to be destroyed when formed. However, they decompose slowly in a strongly acidic environment, since there is a cleavage of the nitrous group, a reaction catalyzed by the presence of nucleophiles such as iodide, thiocyanate, bromide, and/or chloride. The induction of tumors in living organisms by nitrosamines can occur in different organs, depending on the chemical structure of the N-nitrosamine, the concentration, and the source of the exposure. These substances represent a health risk, as they are rapidly absorbed in the gastrointestinal tract and through the skin and accumulate in the organs such as the liver, the bladder, the kidney, the pancreas, the esophagus, the brain, among others, where they induce chronic toxic effects and carcinogenesis. The mutagenicity of these substances occurs due to the easy methylation capacity of the nucleic acid and the organotropism. The high toxigenic power of these substances makes it essential to develop strategies to prevent their formation or eliminate pre-formed n-nitrosamines in the meat products.

These strategies permeate the inhibition of the endogenous nitrosation (at the organic level) or the hybridization of the exogenous nitrosation (in the food), such as the use of natural antioxidants to reduce the levels of nitrosamines. These natural food additives can function mainly as inhibitors of the formation of nitrosamines, acting as blocking agents or inhibitors of the nitrosation reactions, or in reducing the concentration of the nitrites and the nitrates through the action of antioxidants, such as phenolic compounds in general, tannins, alpha-tocopherol, and ascorbic acid. The effect of the ascorbate and the isoascorbate on the formation of nitrosodimethylamine (NDMA) in sausages with permitted levels of the nitrite,There is no significant formation of NDMA. The Ascorbic acid and the alpha-tocopherol had an effective action in the blocking nitrosation in the cured meat, the inhibition of the nitrosamine formation. This effect was also observed in other products based on the cured meat, with the addition of the ascorbates or the erythorbates. The application of this blocking agent was carried out by adding to the curing brine itself together with emulsifying agents or by adding directly to the salt that is applied to the product surface.

A considerable reduction in the nitrosamine levels in pasteurized hams occurred as a result of the use of polyphosphates and sodium nitrite associated with the sodium ascorbate, and a similar effect was also obtained with the alpha-tocopherol. Some spices may have antioxidant activity in the cured meat products in which the sodium or potassium nitrate is added. A component of garlic, s-oxodialyl disulfide, is known to have the ability to inhibit the formation of N-nitrosodimethylamine and prevent nitrite reactivity. Therefore, the use of spices in the meat processing is considered capable of reducing the nitrite residue [98-105].

The Effects on the Health and the Bioavailability of the Natural Antioxidants

The demand for the processed foods, especially ultra-processed foods, is significant and it has a direct relationship with the epidemiological and nutritional transition that has been occurring worldwide in recent decades, characterized by a significant emergence in the occurrence of chronic non-communicable diseases (CND), such as infarction, stroke, systemic arterial hypertension, obesity, diabetes mellitus, and neoplasms. In contrast, consumers began to develop greater interest and a better understanding of the mechanisms that trigger these diseases and their association with eating habits. In this sense, there has been a growing preference and demand for products that contain natural and healthy ingredients, allowing the emergence of a new market niche. The majority of antioxidants added to the meat products to delay or minimize oxidative deterioration have been represented by synthetic compounds (butylated hydroxyanisole-BHA, butylated hydroxytoluene -BHT, tertiary butyl hydroquinone -TBHQ, propyl gallate – PG, and nitrite). However, currently there is already a certain distrust and fear from consumers regarding the safety of the meat products, mainly due to the toxicity and carcinogenicity of these synthetic compounds and the risk of developing diseases associated with their consumption In this context, the interest of research in the pursuit of natural food additives that can replace them and have less associated risk is growing and necessary.

The Vegetable extracts obtained from different sources such as spices, vegetables, herbs, fruits, and oil products are valuable sources of bioactive compounds, having natural antioxidants and most of them have considerable amounts of micro and macronutrients, with reduced anti-nutritional properties. The great antioxidant activity is generally due to the high content of the alpha-tocopherol (the vitamin E), the ascorbic acid (the vitamin C), the beta-carotene (the vitamin A), numerous the flavonoids, the polyphenols, and other phenolic compounds . The Spices and the herbs, in addition to being widely used due to their outstanding flavors, are used for their technological and biological functionalities .The main antioxidant phenolic constituents of the plant species may come from the groups, the terpenoid phenolics (the carnosic acid and the carnosol), the flavonoids (the catechin/ the quercetin), the phenolic acids (the rosmarinic, the gallic, the caffeic acids), and the volatile compounds or the essential oils (the carvacrol, the eugenol, the thymol, and the menthol). These compounds are widely used in the food industry due to their ability to slow the food spoilage, improve the organoleptic quality, and inhibit the growth of pathogens in the products, in addition to various in vivo effects such as the antioxidant, the anticancer, the anti-inflammatory, and the antimicrobial activities [106-112].

The Effects of the Natural Antioxidants on the Microbial Development and the Conservation of the Meat Products

The Extending the shelf life of the meat products is decisive for the industry and the consumers, and can be achieved by protecting against the lipid oxidation and the microbial growth. The intrinsic characteristics of the meat products, such as their chemical composition, high water activity (aw), and pH close to neutrality are the factors that favor the development of an extremely varied microbiota, both pathogenic and deteriorating, which may come from the entire chain production. The Microbial contamination can occur intrinsically or due to the extrinsic factors during the slaughter process, due to the conditions of the slaughterhouse, the equipment, and the transport. Therefore, it is essential to inhibit and control the development of the microorganisms in the food, aiming at their greater safety and preventing the deterioration. The prolonged use of the chemical preservatives and the synthetic antimicrobials to preserve the processed meat products has potentially negative effects on the human health and may contribute to the development of microbial resistance to antibiotics. On the other hand, the knowledge about certain plant species with antimicrobial properties has been revised and expanded, especially due to a worldwide trend regarding the use of the natural antimicrobials in the food preservation. There are a vast number of the natural substances that accumulate the antioxidant and the antimicrobial functions, such as the flavonoids, the phytosterols, the polysaccharides, the alkaloids, the tannins, the coumarins, the vitamins, and the minerals, among others.

The Phenolic compounds present in the rosemary, the sage, the thyme, the hops, the coriander, the cloves, and the basil have effects against the food pathogens. The Natural antimicrobials and its products have been applied to the meat through various technological strategies. The Methods such as direct incorporation of spice powder, marinating, coating with active packaging, or direct addition of the essential oils and the spice extracts to the meat and/or the meat products were followed. The Extracts of the cumin, the cardamom, and the cloves powder 0.1% were applied to the ground meat (fat and lean) and it resulted in the inhibition of the microbial growth and the reduction of the lipid oxidation, maintaining and improving the sensory aspects and increasing the shelf life during storage at room temperature and refrigeration for 25 days. Active films of calcium alginate with Asparagus racemosus extract were applied to the chevon, with the antimicrobial and the antioxidant properties being detected for the product, and with a great potential in improving stability to lipid oxidation, increasing shelf life, and improving the quality of the product storage, without affecting their sensory characteristics. Therefore, it is evident that the use of the extracts and the natural compounds in the meat products can contribute to the overall reduction in the use of the synthetic food additives, as these generally accumulate varied functions, such as the antioxidant and the antimicrobial activities [113-120].

Conclusion

The use of the natural antioxidants in the food products preserves their desirable characteristics and does not pose a risk to the consumers when used in adequate doses, since they are obtained from the foods widely consumed by the population already and accumulate potentially beneficial effects on the human health. In addition, the natural antioxidants generally have other technological features and can be used as preservatives due to their ability to inhibit the microbial development. This demonstrates their great potential in the global reduction in the use of the synthetic food additives, many of which already have shown toxicity. It is essential to use of the antioxidants and other natural food additives in the food products, mainly in the meat products, due to the production of several toxic compounds that are formed during their processing and preparation and due to the growing demand for substitution of the synthetic food additives by the natural ones.

Conflicts of Interest

The author declare no conflicts of interest.

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