Natural Antioxidants. Applications in food of Animal Origin

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In normal health, there is a balance between the formation of oxidizing chemical species and their effective removal by protective antioxidant. Thus oxidative stress is referred to as a condition of imbalanced pro oxidant/antioxidant equilibrium, in favour to the former. If the antioxidant defence mechanism fails, or if an increased flux of reactive oxidant from-and exogenous sources exceeds the antioxidant capacity, oxidative injury will result. An oxidative cell injury or a decreased efficiency of antioxidant defences contribute, therefore, to the development of different pathologies.
However, oxidative stress and lipid peroxidation are the main causes of a number of chronic diseases, the incidence of which can be reduced by the consumption of fruit and vegetables that contain different antioxidant compounds. The consume of the right and well preserved food, therefore, can prevent the cell oxidative damage by inhibiting the generation of reactive oxygen species (ROS) and active nitrogen species (RNS), scavenging free radicals or raising the level of endogenous antioxidant defenses. Few examples of ROS are alkoxyl radicals, peroxyl radicals, hydroxyl radical, and superoxide anion radical, while examples of RNS would be nitric oxide and nitrogen dioxide radical. Potential sources of free radicals could be ultraviolet rays, ionizing radiations, metabolic processes, inflammatory reactions, air pollution and smoking.
Therefore, the increased scientific evidence for protective anti-oxidative mechanisms of vegetables, fruits and some oils and peptides has led to a considerable growing interest of the food industry to support, maintain and possibly increase the antioxidant capacity of the different nutrient products distributed in the market.
This book, developed by **9 chapters**, reports the different strategies used to control the food oxidation processes.
Lipid oxidation is one of the important reactions in food and biological systems because of deleterious effect first of all on polyunsaturated fatty acids (PUFA) but also on other lipid substrates, protein and pigment, causing significant losses in food quality, health, and well-being. This oxidation is also one of the main factors limiting the quality and acceptability of meats and other muscle foods, especially following refrigerated and frozen storages with the primary formation of hydro peroxide compounds by the free radicals formation. PUFA, in fact, interact with oxygen by a mechanism of autoxidation that, by a reaction chain of initiation, propagation and termination, involves the production of free radicals. Initiation occurs when hydrogen, abstracted from an unsaturated fatty acid, results in a lipid-free radical, which, in turn, reacts with molecular oxygen to form a lipid pericycled

radical. Soon after, the propagation phase of oxidation occurs by lipid-lipid interactions, whereby the lipid peroxyl radical abstracts hydrogen from an adjacent molecule, resulting in a lipid hydroperoxide and a new lipid-free radical. The propagation reaction-chain continues until one of the radicals is removed, reacting with another radical or with an antioxidant.

This topic is reported on **chapter 1** where the oxidation mechanisms affecting the quality and acceptability of food are amply discussed. Antioxidants, neutralizing or inhibiting free radicals by preventive and radical scavenging modes, have dual role: shelf-Life prolongation and combating oxidative stress. Thus, to manufacture high -quality, stable food products, the most effective solution is often the addition of these compounds, either synthetic or natural, which can serve as chain breakers, by intercepting the free radical generated during various stages of oxidation or as metal chelators. However, consumers, concerning the bio-safety of synthetic antioxidants, have pushed food industry to seek natural alternatives such as ascorbic acid, tocopherols, polyphenols, and so forth.

They are natural, and have anti oxidative activity that is as good or better than synthetic antioxidants, make them particularly attractive for commercial food processors because of consumer demand for natural ingredients. The role of the different natural antioxidants useful for food preservation is focused a and discussed on **chapter 2**, where the more important natural compounds are reported, evidencing the role and mechanism of action they have to preserve meats and beverages.

Scientific advances, awareness of personal health, increasing healthcare costs, busy lifestyles, and technical advance in the meat industry have stimulated the *green* consumerism. Demands for the natural, ingredients, therefore, have forced researchers and industries to find natural alternatives to synthetic antioxidants. Food, in fact, leading to deterioration in colour, texture, shelf life, and overall acceptability, is easily vulnerable to oxidation because of their chemical constituents and processing, as well as post-processing conditions. However, due to the difficulty to extract from plants, maintain quality and stability of natural antioxidants, it is necessary to carry out more research work to enhance yield, for example, of plant phenolics, screen their active principles, and control their delivery and release in the meat and beverage systems. All these topics and consideration are focused on **chapter 3**. Oxidation in fish and fish products possess a high risk of quality, leading to rancid taste, off-flavour, and development of many different compounds which have adverse effects to human hearth. Oxidation is high in fish because of presence of omega-3 PUFA's susceptible of quick peroxidation because of their electron deficient double bonds. Thus, the oxidative phenomena, affect not only the lipid content causing off-flavour, colour deterioration and rancidity, but also lower the nutritive value of fish, its general freshness and the consumer acceptability.

Fish has and remains an important part of a healthy diet, being a fundamental source of a number of nutrients, particularly protein, vitamin D, retinol, iodine, vitamin E, selenium, and the essential long-chain PUFAs such as eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). Due to their prominent position in human diet and the beneficial effects on chronic degenerative diseases, the food industry and the health authorities have a joint interest in increasing the consumption of fish. Thus, development and application of natural products with antioxidant activities in fish products may be necessary and useful to prolong their shelf life and potential for preventing fish spoilage.

As previously reported, dietary intake of fruits and vegetables rich in phenolic, flavonoid compounds prevents excessive free radical formation in the cell. Hence, utilization of these natural occurring compounds in fish and poultry products will not only increase the storage stability, but also provide adequate health promoting effect to the consumer.

Poultry products are, in fact, rich of bioactive compounds which exert chemomodularity effects through a variety of physiological processes.
In conclusion, the appropriate combination of natural antioxidants can help in designing of functional foods and also tackle lipid oxidation problems. The use of plant extracts and other natural active compounds as protective antioxidants, incorporated in different food with different technologies is reported and discussed on **chapters 4** and **5**.
As amply focused previously, the addition of antioxidants is the most commonly used method of retarding lipid oxidation in fat. They increase the stability of food components especially polyunsaturated lipids, and maintain nutritional value and colour by preventing oxidative rancidity, degradation and discoloration. However, it is important to underline that any compound that is anti-oxidative under one set of conditions, can become pro-oxidative under different conditions. Thus the operative conditions are mandatory as well as type and quantity of the antioxidants used for different foods. However, the ideal antioxidant compound should have the following characteristics: (a) no harmful physiological effects; (b)absence of undesirable effects on colour, odour, or flavour; (c) effective at low concentrations; (d) compatibility with the food and ease of application; (e) survive after processing and be stable in the finished product; and of course (f) available at low cost.
In conclusion, naturally occurring antioxidant substances are at times associated with beneficial effects of foods, also if synthetic antioxidant compounds are also widely used to inhibit progress of lipid oxidation. In any way, food manufacturers have been motivated to carry out research on the use of natural antioxidants because studies have shown that such compounds are not only beneficial to the shelf life of food products but also as preventive medicine.
The safeness of the different natural antioxidant compounds, their use in the different foods according to their anti oxidative capacity, the processing efficiency, the application for processed meat, the relationship between sensory and analytical data, the extraction methods, the more in use analytical methods together with the regulatory aspects are all focused on **chapters 6-9**.
This interesting book, focusing all the aspects of the natural antioxidants from the productive methodologies of extraction, to the application techniques and the regulatory aspects for their use and the rich scientific references reported, represents an important source of news for the chemical and medical community and the food industry experts who wish to have an up-to-date on all the studies and researches carried out on the field of the natural antioxidants used as food preserving compounds.

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