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# Right of using the cured Meat as a Functional food

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## Abstract

Meat can be used as a Functional food and it has a good impact on the public health. A numerus studies have attempted to show how the addition of the various ingredients as vegetables, fibres, extracts, and so on—as well as the removal of the fats and the additives could transform the conventional perception of the meat and meat products into one of healthy living. This review article reveals the potential future trends in the agrofood industry and provides an updated version of the recent studies on using of the Meat as a Functional food and their impact on the public health. It also reveals the changes that occurs in the traditional meat industry as the agrofood industry's global forces increasingly focus it on the development and manufacturing of the functional foods types.

**Keywords:** food ingredients, vegetables, fibres, extracts, traditional meat industry, the consumer demand, agrofood.

## Introduction

The functional foods has led to the publication of several review articles describing studies of the effects including one or more ingredients with the functional properties in the various types of the food, within which the meat and the meat products types deserve special attention. The object of this review article including the functional ingredients in the case of the meat is not only concerned with providing it with certain desirable properties but also an attempt to change its image in these health-conscious days. The meat industry is one of the most important in the world and, whether as a result of the consumer demand or because of the ferocious competition in the industry, research into the new products is continuous. However, such researches and the launch of new products types are directed at providing healthy alternatives to what has frequently been accused of causing a variety of pathologies (1,2,3,4,5 and 6).

This unfortunate image derives mainly from the content of the fat, the saturated fatty acids, and the cholesterol and their association with the cardiovascular diseases, some types of the cancer, obesity, and so forth. Regarding obesity, it is very important to understand how the meat or meat products affects biological and physiological mechanisms of appetite, satiety, and long-term behavior. The meat and the meat products show highly satiating characteristics and, in this respect, functional foods could be a food-related solution because these types of products could be designed to be less calorifically dense and while remaining more highly satiating and tasty. In this way, the food industry in general, the meat and related products industry in particular, could contribute to making lives easier and more active. The meat is associated with cholesterol, and although it is now accepted that the dietary intake of the cholesterol has little bearing on the plasma cholesterol, for consumers this is another negative influence on the meat's health image (7,8,9,10,11 and 12).

In some cases, the consumer is confused by the multiple messages from the multiple sources, public skepticism about expert opinion, the public misunderstanding of reports on the scientific findings and the results, increased media coverage accompanied by the recommendations for corporate marketing strategies and the health claims, and competing the real-life and lifestyle demands. Furthermore, the food packaging could also have a very important influence on the food intake. The underlying idea behind the functional food is to reduce the prevalence of the chronic diseases by curbing the consumption of the habitually consumed foods. The formulation of the foods according to the beneficial effects that their non-nutritional ingredients may have for the consumer has become an area of great interest for the large food companies, including the meat sector (13,14,15,16,17 and 18).

Although there is no exact definition of what a functional food is and many consider that it is a concept still under development, among the most widely accepted definition from a European point of view is that mentioned, namely that "a food may be considered functional if it contains a

component (be it nutrient or not) with a selective effect on one or various functions of the organism, whose positive effects justify that it can be regarded as functional (physiological) or even healthy." A food can be regarded as functional if it is satisfactorily demonstrated to beneficially affect 1 or more target functions in the body, beyond adequate nutritional effects, in a way that is relevant to either improved health or well-being and/or to a reduction in the risk of disease. A functional food must remain food and it must demonstrate its effects in amounts that can normally be expected to be consumed in the diet: it is not a pill or a capsule, but part of the normal food pattern. European consumers are more critical and less unconditional than Americans with this type of product because Europeans have recently suffered a sequence of food safety scares. Also, among countries, perception is very different; for example, in Denmark, consumers are very suspicious of functional foods, which they judge as "unnatural and impure" (19,20,21,22,23 and 24).

As far as meat is concerned, the modifications to which it may be subjected to confer functional properties on it are based on modifications to the feed an animal receives or on postmortem manipulation of the carcass. By the 1st means, the lipid, the fatty acid, and vitamin E content can be modified, whereas by the 2nd, fat can be removed by mechanical processes. Regarding the meat products, efforts are mainly directed toward their reformulation by modifying the lipid and the fatty acid content, and/or by adding a series of functional ingredients (the fiber, the vegetal proteins, the monounsaturated or the polyunsaturated fatty acids, the vitamins, calcium, the phytochemicals, and so forth). The meat and the meat products are essential for a balanced diet, although it must also be remembered that they are susceptible to modifications to give them a "healthier" appearance (25,26,27,28,29 and 30).

The object of this article is to evaluate the effect of adding the functional ingredients on the physical, the chemical, and the sensory characteristics of the foods types, especially the meat and its related products, as understood from recently published scientific review articles. The Functional modifications in the meat and the meat products. The meat and the meat products are essential in the diet of people in the developed countries in the world. Their principal components, besides the water, are the proteins and the fats, with a substantial contribution of vitamins and minerals of a high degree of bioavailability. Both the meat and its associated products can be modified by adding the ingredients considered beneficial for the health or by eliminating or reducing the components that are considered harmful. In this way, a series of the foods can be obtained which, without altering their base, are considered "healthy (31,32,33,34,35 and 36)."

## The Modification of the fatty acid and cholesterol levels in the meat

The meat is in a major source of fat in the diet, especially of saturated fatty acids (SFA), which have been implicated in diseases associated with modern life, especially in developed countries. The ratio of n- 6:n-3 polyunsaturated fatty acids (PUFA) is also a risk factor in cancers and coronary heart disease, especially the formation of blood clots leading to a heart attack. Levels of n-3 PUFA in pigs fed a linseed diet produced higher levels of thiobarbituric acid reactive substances (TBARS) after conditioning for 10 days followed by simulated retail display for a further 7 days, although the display period had no impact on the sensorial characteristics such as muscle color (saturation) (37,38,39,40,41 and 42).

The selection of breeds and genetic lines within breeds, changes in animal feeding practices, including some feed additives (probiotics, antibiotics, and so forth), and intervention in animal metabolism (anabolic implants, -agonist, growth hormone, etc.) are the main tools used to achieve a reduction in carcass fat content, although many such practices are not authorized in the European Union. Compared unweaned lambs and lambs weaned at 40 d of age, fattened at pasture and slaughtered at 28 kg live weight, to observe the effect on the meat quality and fatty acid composition, the weaning status was seen to affect the fatness and quality characteristics of the meat (of lambs raised at pasture) more than the type of feed. A further decrease in the intramuscular fat content would decrease the meat quality attributes, especially juiciness and flavor, which are already impaired in some cases. Variations in the fatty acid composition have an important effect on firmness or softness of the fat in meat, especially the subcutaneous and the intermuscular (carcass) fats but also the intramuscular (the marbling) fat (43,44,45,46,47 and 48).

The effect of fatty acids on the meat shelf life is explained by the propensity of unsaturated fatty acids to oxidise, leading to the development of the rancidity as display times increases. Changes in fatty acid composition have not been directly linked to changes in myoglobin oxidation and muscle color in many of the pork studies. In the studies of the rabbit meat, confirmed that meat enrichment in n- 3 PUFA did not cause any increase in the oxidation level. The -linolenic acid–vitamin E diet favored the accumulation of long chain polyunsaturated n-3 in the meat and improved its oxidative stability and consequently its nutritional value. in studies about feeding linseed to increase the n-3 PUFA in pork meat, confirmed the potential of pork to supply valuable n-3 PUFA to the human diet, finding that it may be readily manipulated to increase the concentrations. The conjugated linoleic acid (CLA) has been recognized as having anticarcinogenic and antioxidative properties in several animal models. The concentration of CLA was significantly increased by the substitution of fat. Storage for 14 d had little effect on the CLA concentration in beef patties. Substituted CLA sources for the fat improved the color stability possibly by inhibition of the lipid oxidation and the oxymioglobin oxidation (49,50,51,52,53 and 54).

**The Addition of** the **vegetal oils to** the **meat products**

The olive oil is the most monounsaturated vegetable oil. It has a high biological value, and its consumption is related to a decreased risk of the heart disease and the breast cancer. The vegetable oils have also been used as partial substitutes of the pork backfat in the low-fat frankfurters and other types of the cooked product giving rise to products with more adequate fatty acid profiles and cholesterol levels than the traditional ones. The studies concerning the use of olive oil to replace (0% to 100%) the pork backfat for the production of the low-fat frankfurters, The higher levels of the olive oil had the lowest acceptability, although the color attributes were unaffected. The manufactured traditional Spanish sausage, replacing 0% to 30% of pork backfat by the pre-emulsified olive oil. The oleic and linoleic acid levels increased and the cholesterol content was reduced, while the sensorial characteristics, (the texture and the color) were comparable with those of commercial products. The results pointed to the possibility of replacing the pork backfat with the olive oil (up to 25%) to increase the nutritional status. The addition of the olive oil to sausages was more effective than using the vacuum-storing methods in avoiding the lipid oxidation during the storage and also increased the monounsaturated fatty acids fraction (MUFA) (55,56,57,58,59 and 60).

The replacement of 20% pork backfat with the olive oil does not affect the weight losses and makes the sausages lighter in the color and more yellow. The product has an acceptable odor and taste but unacceptable appearance because of the intensively wrinkled surfaces and the development of casing the hardening. The replacement of 20% pork backfat by the olive oil in the high and reduced fat Greek sausages led to significant decrease in the oxidation process and significantly increased the MUFA content in “salami” products, The partial substitution of the pork backfat by extra virgin olive oil did not substantially affect the chemical, the physical, and the sensory characteristics of the products, with the exception of the water activity and the firmness. The addition of the extra virgin olive oil, which is rich in the unsaturated fatty acids, did not reduce the shelf life in the terms of lipid oxidation, probably due to the antioxidant effect of both the polyphenols and the tocopherols. The sensory analyses did not point to differences from the traditional formulation.

An alternative to using this vegetable oil, which has a high unsaturated fatty acid content and is liquid at room temperature, is to use the interesterified vegetable oils (IVOs). These oils can be used as a fat replacer to modify the fatty acid composition of the frankfurters and the Turkish type salami without any detrimental changes in the sensory characteristics. The produced frankfurters with IVOs prepared from the palm, the cottonseed, and the olive oils and found that replacing the beef fat (10%) with IVOs (60% to 100%) led to a significant increase in the oleic and the linoleic acid content and the PUFA: SFA ratio without any change in the appearance, the color, the texture, the flavor, or other sensory characteristics.

The addition of the high oleic sunflower oil to the low-fat frankfurters as a source of the monounsaturated fat. The resulting product was healthier due the higher contents of the unsaturated and the essential fatty acids, without any negative sensory characteristics. The Linseed oil is another source of the fat. The substitution of the pork backfat with the linseed oil in the manufacture of the dry-fermented sausages decreased the n- 6:n-3 ratio (from 14.1 to 2.1) as a consequence of the increase in - linolenic acid, this had a relevant influence on the nutritional quality of the products, without substantially modifying the flavor or the oxidation(61,62,63,64,65 and 66).

**The Addition of the soy**

The Plant-derived proteins from the soybeans have been used in traditional comminuted meat products (30% fat) as meat replacements. Soy proteins (flours, concentrates, and isolates) are more commonly used in processed meat products for their functional properties and relatively low cost compared with lean meat.

Soy proteins have been incorporated in these products for their water- binding and fat-binding ability, enhancement of emulsion stability, and increased yields. Soya protein lowers blood lipid levels compared with animal protein. The diets low in saturated fat and cholesterol that include 25 g soy protein per day may reduce the risk of heart disease. Intact soy (with isoflavones) has a greater effect on reducing low-density lipoprotein (LDL) and total cholesterol concentrations than extracted soy. Soy isoflavones include compounds such as daidzin, genistin, daidzein, and genistein. However, it has recently been recognized that the isoflavones contained in vegetable proteins may have a detrimental impact on mammals that consume the vegetable protein. Soy oil also contains approximately 0.2 g plant sterols per 100 g.

Plant sterols and plant stanols are associated with lowering plasma LDL cholesterol at intakes of 2 to 3 g/day. Soy has been described as being useful in the prevention and treatment of cancer, osteoporosis, and in the relief of menopausal symptoms. Some researchers have studied the use of soy derivates in meat products. The addition of Soy protein isolates (SPI) (2.5%) to chorizo raw sausage and found that it prevented drip loss of vacuum-packaged chorizos during refrigerated storage and did not affect the organoleptic and microbiological properties during shelf life of 14 day (67,68,69,70,71 and 72).

Soy protein isolate has been added in low-fat bologna, too. characterized this product and concluded that SPI (2%) can be incorporated as fat replacer without any detrimental physicochemical and textural characteristics being noted in the product, except for color values. The addition of SPI did not seem to change the ultrastructure of the meat protein gel matrix, and no interactions were noted with meat proteins. In other studies by the same authors, 4.4% SPI resulted in a

softer texture of low-fat bologna and did not affect the another chemical parameters (181,182,183,184,185 and 186).

incorporated thermally/enzymatically obtained soy protein isolates (2%) in pork frankfurters. They concluded that heat and enzyme-hydrolyzed soy proteins affected texture properties differently, the 1st improving hardness and 2nd reducing hardness, cohesiveness, and breaking strength. The replacement of pork backfat with soy oil has also been studied. The addition of soy oil did not modify the percentage of water or protein and the pH in fermented sausages. With the addition of pre-emulsified soy oil, cholesterol hardly decreased and oxidation was not modified. Saturated and monounsaturated fatty acids decreased, and polyunsatutared increased due the significant increase in linoleic and - linolenic acids. In the texture profile analyses, the sensory analysis and color did not show significant differences from commercial products (73,74,75,76,77 and 78).

Another product, soy protein concentrate mixed with carrageenan (0% to 3%), was investigated in comminuted scalded sausage. The addition favorably affected the water-holding capacity and thermal stability of the processed sausages regardless of the fat content. It did not improve the textural parameters, and no significant influence on color parameters was observed. Addition of natural extracts with antioxidant properties Lipid oxidation is one of the causes for the deterioration of meat and derivatives because their appearance determines the onset of a large number of undesirable changes in flavor, texture, and nutritional value. The rate of lipid oxidation can be effectively retarded by the use of antioxidants. Synthetic antioxidants were widely used in the meat industry, but consumer concerns over safety and toxicity pressed the food industry to find natural sources. Natural antioxidants extracted from plants such as rosemary, sage, tea, soybean, citrus peel, sesame seed, olives, carob pod, and grapes can be used as alternatives to the synthetic antioxidants because of their equivalent or greater effect on the inhibition of lipid oxidation. The human intake of green tea decreases total cholesterol, increases the high-density lipoprotein (HDL) fraction, and decreases lipoprotein oxidation (175,176,177,178,179 and 180).

The addition of tea catechins to cooked red meat and poultry, the addition at 300 mg/kg minced muscle significantly inhibited the pro-oxidative effect of NaCl and controlled lipid oxidation in cooked muscle patties. The high affinity of tea catechins for lipid bilayers of muscle and their radical scavenging abilities may provide a possible mechanism to explain the inhibition of lipid oxidation in cooked muscle food. The functional properties of raw and cooked pork patties with added irradiated green tea leaf extract was studied. This extract did not have negative effects on the physical and sensory properties and had beneficial biochemical properties; the researchers concluded that irradiated green tea extract powder can be used to add functional properties to pork patties. added irradiated, freeze-dried green tea to cooked pork patties. The results show that this ingredient had no negative effects on the physical and sensory properties. Lipid oxidation was lower and showed less cooking loss. Also, the patties with added green tea leaf extract had beneficial biochemical properties.

Another extract used in meat products is rosemary, from whose leaves a large number of phenolic compounds with antioxidant activities have been isolated. These include carnosol, carnosic acid, rosmanol, epirosmanol, isorosmanol, rosmarinic acid, rosmaridiphenol, and rosmariquinone. manufactured wiener sausages with this extract, and no lipid oxidation was observed in the product during long-term frozen storage. Wieners containing rosemary appeared to have slower rates of oxidation than those without antioxidant (79,80,81,82,83 and 84).

**Sodium chloride control**

Due to the role of sodium in the development of hypertension in sodium-sensitive individuals, public health and regulatory author-ities have recommended a reduced dietary intake of sodium choride. However, intake still exceeds the nutritional recommendations in many countries. The main source of sodium chloride in meat products is salt (NaCl), and its reduction in meat products is an important goal for decreasing overall dietary sodium. Because salt contributes to water and fat binding in meat products, its reduction has an adverse effect on these parameters increasing cooking loss and weakening the texture (169,170,171,172,173 and 174).

Although meat as such is relatively poor in sodium, containing only 50 to 90 mg of sodium per 100 g, the sodium content of meat derivatives is much higher because of the salt content, which may reach 2% in heat-treated products and as much as 6% in uncooked cured products, in which drying (loss of moisture) increases the proportion even further. Estimates taking eating habits into account suggest that approximately 20% to 30% of common salt intake comes from meat and meat derivatives. The physical and sensory properties of low-salt phosphate-free frankfurters and concluded that when the frankfurters were made without phosphate, additional nonmeat ingredients (modified tapioca starch, sodium citrate, and wheat bran) were needed when the salt contents was below 1.5%. Salt directly affects frying loss, water and fat binding, firmness, saltiness, and flavor intensity (85,86,87,88,89 and 90).

The evaluation of the quality characteristics of low-salt bologna-type sausage manufactured with sodium citrate, carboxymethyl cellulose, and carrageenan. The results show that in low-salt sausages containing less than 1.4% NaCl, the use of these ingredients decreased frying loss and increased saltiness, but the conclusion was that in low-salt sausages, no additive alone is recommended. In the same study, salt affected frying loss, firmness, saltiness, juiciness, and flavor intensity. calcium ascorbate as a potential partial

substitute for NaCl in dry-fermented sausages, in which substitution caused higher acidification as a result of greater lactic acid bacteria development, probably due to the presence of calcium.

Partial replacement of NaCl by calcium ascorbate seems to be a viable way of decreasing sodium in dry-fermented sausages. It would imply enrichment in ascorbate and calcium with advantages from the nutritional point of view. The salt reduction affects *L**, *a**, and *b** CIELAB coordinates (Commission Internationale de l'Eclariage) and also affects hardness, gumminess, and chewiness (91,92,93,94,95 and 96).

**Addition of fish oils**

Oils in the form of n-3 polyunsaturated fatty acids occur mainly in cold water fish, whereas n-6 polyunsaturated fatty acids come mainly from plants and saturated fatty acids from animal sources. Diets in which cold water fish such as mackerel (*Scomber scombrus*), salmon (*Salmo salar*), halibut (*Hippoglossus hippoglossus*), and trout *(Oncorhynchus mykiss)* are the main staple are associated with reduced incidence of coronary heart disease but an increased risk of hemorrhage (163,1644,165,166,167 and 168).

Epidemiological, clinical, and biochemical studies have provided a great deal of evidence about the protective effect of n-3 polyunsaturated fatty acids against some common cancers such as breast and colon cancer, rheumatoid arthritis, inflammatory bowel diseases, and cardiovascular diseases. Levels of dietary fish oil and dietary antioxidant significantly influence the n-3 fatty acid and cholesterol content of meat lipids.

The addition of fish oil (2% to 4%) to the diet of chickens used to make it, no significant differences were found in pH, cooking yield and moisture, fat, protein, ash and cholesterol contents, and sensory quality. These frankfurters had higher contents of eicosapentaenoic acid (EPA) and docosahexanoic acid (DHA), but a lower content of n-6 fatty acids. The manufactured salchichon using backfat and meat enriched in polyunsaturated n-3 fatty acids and _-tocopherol, concludeing that it is possible to manufacture dry-fermented sausages enriched in n-3 PUFAs without adverse effects on its composition, lipid stability, textural, and sensory properties (97,98,98,100,101 and 102).

**Addition of vegetal products**

Vegetables are the main ingredient of a range of meat-free dishes and convenience products such as vegetable burgers, vegetable-based sausages, vegetable grills, and ready meals. The attributes of vegetables include high fiber, low fat, and low energy density. Particular types of vegetables can also be a good source of vitamins including vitamin C, folic acid, other B vitamins, vitamins E and K, potassium, dietary antioxidants such as carotenoids and flavonoids, and a range of other potentially beneficial phytochemicals.

Protein derivatives of vegetable origin have been used in meat products for technological purposes to reduce formulation costs, and they have even been used for their nutritional value. The use of wheat protein as a meat alternative is a relatively recent development. Wheat protein is essentially made from gluten that has been processed and extruded to resemble the texture of meat (157,158,159,160,161 and 162).

The effect of adding different decorticated legume flours to buffalo meat burgers and showed that the inclusion of roasted black gram flour led to lower thiobarbituric acid values before frying and found the burger organoleptically acceptable even after storage at –16 ± 2 °C for 4 mo.

Nuts provide high levels of protein. Several studies have demonstrated an inverse association between nut consumption and the risk of cardiovascular diseases (CHD). Although nuts are high in fat, they contain a high proportion of unsaturated fats, including monounsaturated fats, which can contribute a cholesterol-lowering effect when used to replace dietary fatty acids and/or carbohydrate. Walnuts, peanuts, and almonds are also a source of _-linolenic acid, as are mycoprotein and soya oil. Nuts also contain dietary fiber and various bioactive compounds such as plant sterols, which have cholesterol lowering properties.

The addition of walnuts affects the cooking properties, color, texture, and sensory attributes, making the product softer and providing it with better water-binding properties. Product morphology studies suggested that walnut interferes with the formation of protein network structures (103,104,105,106,107 and 108).

**Addition of fiber**

Epidemiological research has demonstrated a relationship between a diet containing an excess of energy-dense foods rich in fats and sugar and the emergence of a range of chronic diseases, including colon cancer, obesity, cardiovascular diseases, and several other disorders, an increase in the level of dietary fiber in the daily diet has been recommended. The presence of fiber in foods produces a diminution in their caloric content (151,152,153,154,155 and 156).

Fiber is suitable for addition to meat products and has previously been used in cooked meat products to increase the cooking yield due to its water-binding and fat-binding properties and to improve texture. Various types of fiber have been studied alone or combined with other ingredients for formulations of reduced-fat meat products, largely ground and restructured products, and meat emulsions (109,110,111,112,113 and 114).

Rye bran was used as a fat substitute in the production of meatballs. Rye consumption has been reported to inhibit breast and colon tumor growth in animal models, to lower glucose response in diabetics, and to lower the risk of death from coronary heart disease. The addition of rye bran to meatballs at the levels assayed (5% to 20%) improved their nutritional value and health benefits. The total trans fatty

acid content was lower and the ratio of total unsaturated fatty acids to total saturated fatty acids was higher in the samples with added rye bran. The same samples were lighter and yellower than the control samples. The authors concluded that this type of fiber can be used as dietary fiber source (115,116,117,118,119 and 120).

Another source of fiber is oat. Many of the characteristics of oat fiber such as its water-absorption capacity could potentially benefit products such as fat-free frankfurters and low-fat bologna. Oat products have also achieved a very positive consumer image because of the health benefits that have been associated with their consumption. Oat was added to determine the effects on the quality characteristics of light bologna and fat-free frankfurters. Different types of oat fiber were used, high absorption (HA) or bleached oat (BL) fiber at levels up to 3%.

The results indicated that the addition of both types of oat fiber produced greater yields and a lighter red color. Purge was reduced with oat fiber at 3%. Product hardness increased for bologna. It has been reported that oat bran and oat fiber provide the flavor, texture, and mouthfeel of fat in ground beef and pork sausages (121,122,123,124,125 and 126).

The components of dietary fiber include fructo-oligosaccharides (FOS), a generic name for all nondigestible oligosaccharides composed mainly of fructose. The effect of a short-chain FOS on cooked sausages. The addition did not affect the pH, aw or weight losses because the presence of soluble dietary fiber (SDF) leads to a compact gel structure and therefore prevents proteins from retaining the water. The energy values decreased from 279 kcal/100 g in the conventional control to 187 kcal/100 g in the reduced-fat sausages with 12% added fiber at 12% SDF. The hardness of the samples with SDF was lower, and the overall acceptability in the sensory analysis was higher in samples with 12% SDF.

Another SDF is inulin, which can be used as a fat substitute mainly in nonmeat foods (cakes, chocolates, dairy products, spreads) because of its contributions to better mouthfeel, enhanced flavor, and low-caloric value (1.0 kcal/g). Low-fat, dry-fermented sausages with a fat content close to 50 and 25% of the original amount and supplemented with 7.5 and 12.5% of inulin. The results indicate that inulin impacts a softer texture and a tenderness, springiness, and adhesiveness very similar to that of conventional sausages. A low-calorie product (30% of the original) can be obtained with approximately 10% inulin (127,128,129,130,131 and 132).

Epidemiological studies have shown that the consumption of fruits and vegetables imparts health benefits, for example, reduced risk of coronary heart disease, stroke, and certain types of cancer. Apart from the dietary fiber, fruits and vegetables contain health benefits that are mainly attributed to organic micronutrients such as carotenoids, polyphenolics, tocopherols, vitamin C, and others.

Inner pea fiber was identified as an ingredient capable of retaining high fat and water in ground beef. Inner pea fiber is manufactured from the inner cell walls of yellow field peas and contains approximately 48% fiber, 44% starch, and 7% protein. This fiber may improve the sensory properties of lower fat ground beef by retaining substantial amounts of both the moisture and fat that are normally lost during cooking. This source was added in a dry form to lower-fat beef patties (10% and 14%), in which it improved tenderness and cooking yield without having negative effects on juiciness and flavor (133,134, 135,136,137 and 138).

Another important source of fiber is fruits, which can also be obtained as by-products of plant food processing. Citrus byproducts (lemon albedo and orange fiber powder) have been added, at different concentrations, to cooked and dry-cured sausages with excellent results. Lemon albedo was added at different concentration (2.5% to 10%) to cooked sausages and dry-cured sausages. The addition of lemon albedo to both sausages had healthy effects due to the presence of active bio compounds, which induced a decrease in residual nitrite levels. Sausages with 2.5% to 7.5% lemon albedo added had sensory properties similar to conventional sausages. Orange fiber powder was added at different concentrations (0.5% to 2%) to cooked sausages (bolognas). The results showed that the addition improved the nutritional value, decreased the residual nitrite level, and delayed the oxidation process as determined by TBA values and the red color. Citrus fiber at all concentrations made the products harder and less springy and chewy. All the samples had a similarly good score in the sensory analysis, except the sample with 2% citrus fiber. The effect of adding cereal and fruit fibers on the sensory properties of reduced-fat, dry-fermented sausages. The cereal (wheat and oat) and fruit (peach, apple, and orange) dietary fibers were added at 1.5% and 3% concentrations (139,140,141,142,143 and 144). The addition of dietary fiber from cereals and fruits at 1.5% resulted in sausages with a final fiber content, after ripening, of about 2%, which represents an improvement in their nutritional properties and provides an acceptable sensory profile. Higher amounts of fiber (3%) increased the hardness, resulting in products with a lower sensory quality. The best results in this study were obtained with sausages containing 10% pork backfat and 1.5% fruit fiber. The orange fiber provides the best results with sensory properties similar to those of conventional sausage (145,146,147,148,149 and 150).

## Conclusion:

Meat and meat products can be altered by removing or lowering ingredients that are deemed detrimental or by introducing ingredients that are thought to be healthful. By adding these components to meat products, processors can enhance the goods' nutritional value and overall wellness. However, there are instances in which the usage of these compounds leads to goods with inferior sensory and

physicochemical quality—particularly when they are added in excessive amounts. The findings indicate that a wide range of compounds may be added to meat products to provide them functional qualities, but further investigation is required to comprehend how these chemicals interact with the components of meat products and hence enhance their safety for possible industrial uses.

## Conflicts of Interest:

The author declare no conflicts of interest.

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