

Recent Advances in Improving the Health Properties of Meat Products

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Abstract—Meat is a vital source of protein, vitamins, and minerals, but its excessive consumption—especially of red and processed varieties—has been linked to chronic diseases such as cardiovascular conditions, type 2 diabetes, and certain cancers. As concerns over meat-related health risks grow, recent research has focused on enhancing the health properties of meat products without compromising their sensory quality. This review highlights advances in the incorporation of functional ingredients (e.g., natural antioxidants, probiotics, and prebiotics), novel processing techniques (e.g., high pressure processing, sous vide, and improved smoking methods), and optimized animal feeding strategies (e.g., omega-3 enriched diets) to improve the nutritional profile and safety of meat. These approaches aim to reduce harmful compounds, extend shelf life, and enrich meat with health-promoting nutrients. While promising, these strategies also face challenges regarding taste, cost, and scalability. Future research should aim to optimize these interventions and explore innovative methods to promote healthier and more sustainable meat consumption.

Key Words: Meat, Functional ingredients, Animal feeding. Novel processing

I. INTRODUCTION

Meat is a valuable source of essential nutrients, such as protein, vitamins, and minerals, and has been a part of human diets for centuries[1]. The microbiome plays a crucial role in the health properties of meat and meat products, which are important sources of essential nutrients in the human diet and can impact overall health and well-being[2], [3], [4], [5]. However, the consumption of meat, particularly red and processed meats, has been associated with various health risks[6], [7]. Excessive meat consumption has been linked to an increased risk of chronic diseases, including cardiovascular disease, type 2 diabetes, and certain types of cancer. In recent years, there has been a growing concern about the potential adverse health

effects of consuming meat, which has prompted researchers to explore various strategies to improve the health properties of meat products while maintaining their sensory attributes and quality. This draft aims to provide an overview of recent advances in improving the health properties of meat products, including the use of functional ingredients, processing techniques, and animal feeding strategies, in order to promote a healthier and more sustainable meat consumption pattern[8].

II. FUNCTIONAL INGREDIENTS

Functional ingredients are additives that are added to food products to provide additional health benefits beyond their basic nutritional value. In recent years, researchers have been exploring the use of natural antioxidants, probiotics, and prebiotics as functional ingredients in meat products to enhance their health properties. Natural antioxidants, such as polyphenols and flavonoids found in fruits and vegetables, have been found to have potential health benefits, including reducing the risk of chronic diseases[9], [10], [11]. These compounds have been added to meat products to inhibit lipid oxidation and improve their oxidative stability. This can improve the shelf life of meat products and enhance their nutritional profile. Probiotics are live microorganisms that are added to food products to provide health benefits to the consumer. They have been shown to have potential health benefits, including improving gut health, enhancing the immune system, and reducing the risk of certain diseases. Probiotics have been added to meat products to improve their functional properties and to enhance their sensory attributes. Prebiotics are non-digestible food components that promote the growth of beneficial bacteria in the gut. They have been added to meat products to improve the survival and growth of probiotics during storage and processing[12], [13].

This can improve the functional properties of meat products and also enhance their nutritional value. However, further research is needed to better understand the mechanisms by which these compounds affect the properties of meat products and to optimize their application in different types of meat products.

III. PROCESSING TECHNIQUES

Processing techniques play a crucial role in the safety and quality of meat products. In recent years, researchers have explored various techniques to reduce the formation of harmful compounds in meat products[14]. Three such techniques are high pressure processing, sous vide, and smoking. High pressure processing (HPP) is a non-thermal processing technique that uses high pressure to eliminate microorganisms and pathogens. HPP has been found to be effective in reducing the levels of harmful bacteria in meat products, while also preserving their nutritional and sensory properties. HPP has also been shown to reduce the formation of harmful compounds, such as heterocyclic amines, in meat products[15]. Sous vide is a low-temperature cooking technique that involves sealing meat in an airtight bag and cooking it in a water bath. This technique has been found to reduce the formation of harmful compounds in meat products compared to traditional cooking methods, such as grilling or frying. Sous vide also helps to preserve the nutritional value and tenderness of meat products. Smoking is a traditional preservation method that adds flavor to meat products. However, the smoke generated during smoking contains harmful compounds, such as polycyclic aromatic hydrocarbons (PAHs) and nitrosamines, which have been linked to cancer. To reduce the formation of these harmful compounds, researchers have explored various smoking techniques, including the use of different types of wood and additives. These techniques can reduce the levels of harmful compounds in smoked meat products while maintaining their flavor and aroma[16].

IV. ANIMAL FEEDING STRATEGIES

Animal feeding strategies play a critical role in the nutritional quality of meat products. In recent years, researchers have explored various feeding strategies to improve the nutritional profile of meat products. One

such strategy is the use of feed additives, such as omega-3 fatty acids. Omega-3 fatty acids are essential nutrients that have been found to have numerous health benefits, including reducing the risk of cardiovascular disease, improving cognitive function, and reducing inflammation. However, the typical Western diet is often deficient in omega-3 fatty acids. This has prompted researchers to explore the use of feed additives to increase the levels of omega-3 fatty acids in meat products. Feeding animals with omega-3-rich feeds, such as flaxseed or fish oil, has been found to increase the levels of omega-3 fatty acids in meat products[17]. This can improve the nutritional profile of meat products and also provide health benefits to consumers. In addition to improving the omega-3 fatty acid content, feed additives can also improve the fatty acid composition, reduce the levels of saturated and trans fats, and increase the levels of beneficial nutrients, such as vitamin E[18]. However, there are also limitations associated with these strategies. The use of certain feed additives may affect the taste and sensory properties of meat products. Additionally, some processing techniques may be time-consuming and expensive, and the safety and efficacy of these techniques need to be carefully evaluated.

Future research directions in this field should focus on optimizing these strategies and evaluating their safety and efficacy. Further studies are needed to determine the optimal concentrations of functional ingredients, processing conditions, and feeding regimes for different types of meat products. In addition, researchers should also explore novel strategies, such as the use of novel ingredients and innovative processing techniques, to further enhance the health properties of meat products[19]. Recent advances in improving the health properties of meat products have opened up new avenues for developing healthier and safer meat products. By continuing to explore and refine these strategies, we can provide consumers with meat products that not only taste good but are also good for their health.

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