

Effect of Rosemary Extract on the Oxidative Stability and Quality of Sausages

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Abstract: *The present paper aims to develop a type of sausages enriched with a natural antioxidant, namely rosemary extract, in order to improve oxidative stability and extend shelf life. The objective of this study is to highlight the effect of incorporating rosemary extract on the physicochemical, sensory, and nutritional characteristics of the final product.*

The first part presents the current context regarding the growing interest in clean-label meat products and the replacement of synthetic additives with natural alternatives. The antioxidant properties of rosemary extract are emphasized, focusing on its content of phenolic compounds (such as carnosic acid and rosmarinic acid), which contribute to delaying lipid oxidation in meat systems.

The second part includes the author’s own contributions, consisting of formulation, technological processing, and characterization of four sausage variants: a control sample (without antioxidant) and three variants with increasing concentrations of rosemary extract.

The products were analyzed from organoleptic, physicochemical, and sensory points of view. The results showed that the addition of rosemary extract significantly reduced lipid oxidation and improved product stability during storage, without negatively affecting sensory attributes. Slight improvements in flavor and overall acceptability were also observed at optimal concentrations.

This study supports the potential use of rosemary extract as a natural antioxidant in the meat industry, contributing to the development of safer, more stable, and consumer-friendly products.

Keywords: *sausages, rosemary extract, natural antioxidant, lipid oxidation, sensory analysis*

• Introduction

Meat and meat products are the main components of the human diet due to their high nutrient content (proteins, vitamins, fats, minerals) as well as their high digestibility and numerous preservation options. Lipid oxidation in food is considered a risk factor for human health. Certain lipid products are considered atherogenic agents with mutagenic and carcinogenic properties. Lipid oxidation is responsible for the development of off-flavors and odors, as well as for changes in color, rheological properties, and the formation of toxic compounds. There is a close relationship between the oxidation of heme pigments and the oxidation of lipids in meat and meat products. Studies on hemoglobin pigments in meat indicate that they initiate and catalyze the oxidation of muscle tissue lipids, leading to the development of rancid odors and flavors. Free radicals produced during lipid oxidation can oxidize hemoglobin pigments, causing discoloration of meat and meat products. In addition, myoglobin catalyzes lipid oxidation; iron ions (Fe^{2+} , Fe^{3+}) present in hem are more potent pro-oxidants than free radicals. The search for alternative methods to delay oxidative processes in meat and meat products has led researchers to investigate natural antioxidants. The addition of antioxidants to meat products is known to be effective in preventing the formation of metmyoglobin.

• Materials and methods

Raw materials: beef trimmings (45 kg), grade II beef (15 kg), beef fat (25 kg), spices, casings

Additive: rosemary (as a natural antioxidant in place of BHA/BHT)

Samples: beef salami with rosemary vs. control (without rosemary)

Analyses: moisture, protein, fat, NaCl, nitrites, ash, carbohydrates, energy value, Kreiss reaction, oxidative capacity (TBA test).

• Results and discussions

Proximate composition

The physicochemical analysis of the beef salami with rosemary sample revealed a compositional profile that meets legal requirements for all evaluated criteria. The moisture content (45.26%) is below the 50% limit, and the fat content (19.22%), which is inversely proportional to it, is significantly lower than the 40% limit (Ordinance 210/2006), giving the product a dietary character. The high protein content (21.06%), exceeding the legal minimum of 15%, reflects the quality of the raw material and ensures a high biological value of the product, supported by the mineral content of 1.85%, which plays a role in protein metabolism and hemoglobin synthesis.

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The NaCl content (1.97%) falls below the 3% limit, ensuring the product’s organoleptic properties and preservative effect. The complete absence of nitrites (0 mg/kg compared to the limit of 60 mg/kg) is a remarkable result, demonstrating that rosemary can replace synthetic antioxidants, eliminating the risk of forming potentially carcinogenic nitrosamines. The carbohydrate content (10.64%), slightly higher than that of similar products in the literature, is attributed to the spices and additives in the recipe. Overall, the energy value of 299.78 kcal/100g, lower than the average of 385 kcal/100g reported for similar products, confirms the moderate energy profile and recommends the product as a healthier alternative to traditional beef salamis.

Table 1. Physicochemical characterisation of beef salami with rosemary (Order 210/2006)

Parameter	Measured value	Legal limit Order 210/2006
Moisture (%)	45.26	max. 50.00
Protein (%)	21.06	min. 15.00
Fat (%)	19.22	max. 40.00
NaCl (%)	1.97	max. 3.00
Nitrites (mg/kg)	0	max. 60.00
Ash (minerals) (%)	1.85	—
Carbohydrates (%)	10.64	—
Energy value (kcal/100g)	299.78	—
Reference intake (%)	14.99	—
Kreiss reaction	negative	negative

Oxidative capacity (TBA test).

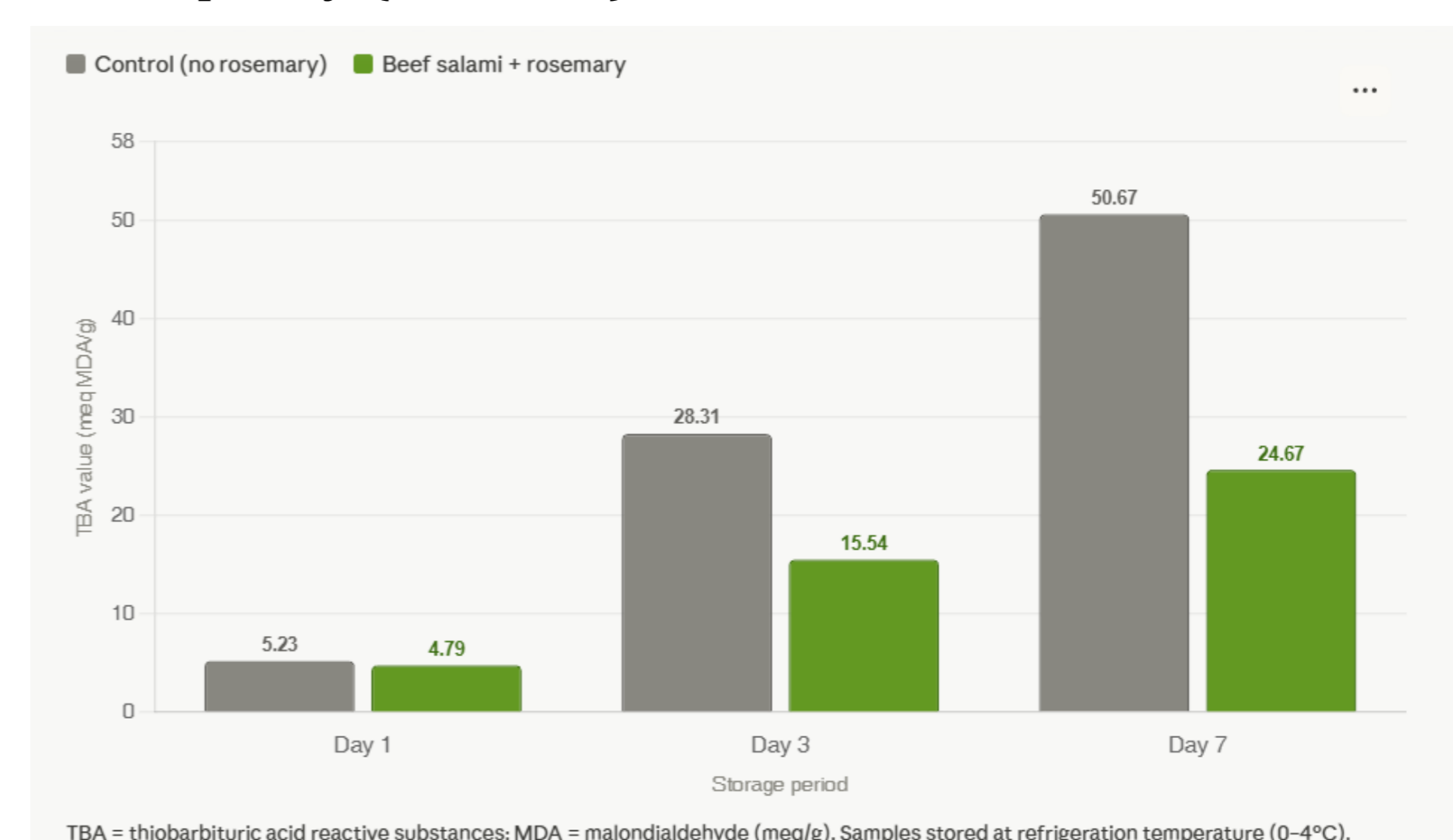


Figure 1. Oxidative stability of sample

The graph clearly shows the progression of lipid oxidation over the 3 days of storage for both samples. The difference becomes increasingly pronounced over time—on day 7, the rosemary sample (24.67 meq/g) recorded 51.3% less than the control (50.67 meq/g), visually confirming rosemary’s effectiveness as a natural antioxidant.