



## Research Paper

# The Effect of Ethanolic Extracts of *Boswellia Serrata* Gum and *Glycyrrhiza Glabra* Root in Reducing the Oxidation Rate and Acrylamide Content of Beef Burger Under Shallow Frying Conditions

Sahar Yazdanmehr<sup>1</sup>, Toktam Mostaghim<sup>2\*</sup>

<sup>1</sup>M.Sc. Department of Food Science and Technology, Shahr-e-Qods Branch, Islamic Azad University, Tehran, Iran

<sup>2</sup>Assistant Professor, Department of Food Science and Technology, Shahr-e-Qods Branch, Islamic Azad University, Tehran, Iran

\*Corresponding author: Toktam Mostaghim, Email: [toktammmostaghim@yahoo.com](mailto:toktammmostaghim@yahoo.com)

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## Extended Abstract

### Introduction

Hamburgers are a popular processed meat product due to their ease of consumption, high protein content, and favorable taste. However, the frying process, which enhances flavor and texture, also leads to lipid oxidation and the formation of potentially harmful compounds such as acrylamide. Acrylamide is a known toxicant formed mainly through the Maillard reaction between reducing sugars and free asparagine under high-temperature conditions. Given the health risks associated with acrylamide and lipid oxidation, there is a growing interest in natural antioxidants to mitigate these effects. This study investigates the impact of ethanol extracts of frankincense gum and licorice root as natural antioxidants in reducing acrylamide formation and lipid oxidation in beef hamburgers.

### Methods

Ethanol extracts of frankincense gum and licorice root were prepared and incorporated into beef hamburger formulations at 1%, 1.5%, and 2% w/w. An additional formulation containing a 1:1 combination of both extracts was also tested. The treated hamburger samples were shallow-fried at 170°C for 8 minutes. Various physicochemical and analytical assessments were conducted, including pH measurement, acrylamide quantification using

HPLC, and lipid oxidation evaluation through peroxide value (PV), anisidine value (AV), thiobarbituric acid reactive substances (TBA), and Totox index.

## Results and Discussion

The addition of frankincense gum and licorice root extracts did not significantly affect the pH of the hamburger samples. However, both extracts exhibited a pronounced effect on reducing acrylamide content and lipid oxidation. The highest reduction in acrylamide was observed at 2% extract levels, with licorice root showing a more significant effect (49.87% reduction) compared to frankincense gum (32.95% reduction). The combined extract treatment resulted in acrylamide levels comparable to the 1.5% licorice root treatment. Lipid oxidation indices demonstrated a significant decline in oxidative markers with increasing extract concentration. Peroxide value (PV), anisidine value (AV), and TBA levels were substantially lower in treated samples compared to the control, indicating strong antioxidant activity. The lowest oxidative stress markers were observed in samples containing 2% licorice root extract. The combined extract formulation also showed notable antioxidative properties, reducing lipid oxidation effectively. Sensory evaluation revealed that the extracts did not alter the texture or color of the hamburgers. However, increasing the concentration of licorice root extract led to a decline in flavor and overall acceptability, likely due to its inherent strong taste. The combined extract formulation maintained sensory acceptability comparable to the control. These findings suggest that frankincense gum and licorice root extracts can serve as effective natural additives for mitigating both acrylamide formation and lipid oxidation in meat products without compromising basic sensory qualities. The pronounced effect of licorice root extract, particularly at 2%, highlights its strong antioxidative and anti-acrylamide potential, which may be attributed to its high content of phenolic compounds and bioactive constituents. The ability of the combined formulation to maintain similar functional benefits while preserving sensory acceptability indicates a promising strategy for balancing health-promoting properties with consumer preferences. Nevertheless, the decline in flavor acceptability at higher licorice concentrations underscores the importance of optimizing dosage levels for commercial applications. Future research should explore the mechanisms by which these extracts reduce acrylamide formation, assess their stability during extended storage, and evaluate their efficacy in other thermally processed foods to broaden their potential in functional food development.

## Conclusion

The findings of this study indicate that ethanol extracts of frankincense gum and licorice root can effectively reduce acrylamide formation and lipid oxidation in shallow-fried beef hamburgers. The licorice root extract demonstrated superior antioxidant activity, whereas the combined extract formulation provided a balance between antioxidative efficacy and sensory acceptance. These natural antioxidants could serve as viable alternatives to synthetic preservatives, contributing to healthier meat products. Future research should explore the optimization of extract concentrations to maximize health benefits while maintaining consumer preference.

**Keywords:** Hamburger, Acrylamide, Oxidation, *Boswellia serrata* gum, *Glycyrrhiza glabra* root

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