# SHIITAKE (*Lentinula edodes*) STIPE EXTRACT AS AN ANTIOXIDANT IN FRANKFURTERS WITH SOYBEAN OIL AS ANIMAL FAT SUBSTITUTE

Miriam M. Selani[1, 2*], Tatiana Pintado[2], Erick Saldaña[3], Izabela D. Alvim[4], Ana M. Herrero[2], Claudia Ruiz-Capillas[2]

[1] Center of Nature Sciences, Federal University of São Carlos (UFSCar), Buri, Brazil

[2] Institute of Food Science, Technology and Nutrition (ICTAN-CSIC), José Antonio Novais 6, 28040, Madrid, Spain

[3] Sensory Analysis and Consumer Study Group, Escuela Profesional de Ingeniería Agroindustrial, Universidad Nacional de Moquegua, Moquega, Peru

[4] Cereal and Chocolate Technology Center (CEREAL CHOCOTEC), Institute of Food Technology, Campinas, Brazil

*Corresponding author email: miriamselani@ufscar.br

## I. INTRODUCTION

The growing awareness among the population regarding the importance of a healthy diet has increased consumers' concerns about excessive intake of saturated fat, salt, and synthetic additives, driving the demand for more natural and healthier meat products [1]. Consequently, various approaches have been studied to meet consumers' expectations, including substituting animal fat with vegetable oils, such as soybean oil, to improve the lipid profile of meat products [2]. Additionally, the use of natural extracts as substitutes for synthetic additives has gained attention due to consumers' concerns regarding the safety and toxicity of these substances. Shiitake mushrooms and their byproducts, contain phenolic compounds in their composition [3], offering potential as substitutes for commercial antioxidants. This study aimed to evaluate the effect of shiitake stipe extract on the antioxidant activity and oxidative stability of frankfurters with soybean oil as an animal fat substitute.

## II. MATERIALS AND METHODS

The shitake stipe extract (SSE) was obtained according to Harada-Padermo et al. [4]. Five formulations of frankfurters were prepared [5]. One was the Control (C) [100% animal fat and 0.05% sodium erythorbate (SE) as an antioxidant], and four were reformulated with 50% of pork backfat replaced by soybean oil: one with SE (0.05%) (S), and three replacing SE with SSE at 0.75% (S0.75), 1% (S1), and 1.5% (S1.5). Pork meat (58%), water (19.64%), sodium chloride (0.75%), sodium tripolyphosphate (0.3%), sodium nitrite (0.012%), and seasoning (0.25%) were used in all formulations. The fatty acid profile (determining the proportion of SFA, MUFA and PUFA) [6], lipid oxidation (TBARS) [6], and antioxidant activity by photochemiluminescence (Photochem, Analytik Jena, TX, USA) were analyzed, with the latter two assessments conducted during 60 days of refrigerated storage. Results were evaluated by ANOVA followed by Tukey's test ($p<0.05$).

## III. RESULTS AND DISCUSSION

The incorporation of soybean oil in the formulation of frankfurters significantly ($p<0.05$) reduced SFA and MUFA while increasing PUFA (Figure 1A), demonstrating the positive effect of the partial replacement of pork fat by soybean oil on the lipid profile. Samples containing SE (C and S) showed significantly higher antioxidant activity ($p<0.05$) than S0.75, S1, and S1.5 throughout the storage period (Table 1), indicating that the sodium erythorbate exhibits greater antioxidant capacity than shiitake stipe extract in sausages. Despite this, when evaluating lipid oxidation (Figure 1B), samples S1 and S1.5 did not differ ($p>0.05$) from formulations containing SE (C and S) throughout the storage period. This indicates that SSE, at concentrations starting from 1%, effectively acted as an antioxidant in the frankfurters.

Table 1 - Antioxidant activity by Photochemiluminescence (µg TEAC/g) of frankfurters

| Samples | Storage time (days) | | | |
|---|---|---|---|---|
| | 0 | 20 | 40 | 60 |
| C | 0,56±0,01 $^{aA}$ | 0,38±0,03 $^{bD}$ | 0,49±0,02 $^{aB}$ | 0,45±0,01 $^{aC}$ |
| S | 0,60±0,04 $^{aA}$ | 0,47±0,01 $^{aB}$ | 0,38±0,01 $^{bC}$ | 0,35±0,02 $^{bC}$ |
| S0.75 | 0,06±0,01 $^{bA}$ | 0,06±0,00 $^{cA}$ | 0,06±0,00 $^{cA}$ | 0,06±0,00 $^{cA}$ |
| S1 | 0,07±0,00 $^{bA}$ | 0,07±0,00 $^{cA}$ | 0,07±0,00 $^{cA}$ | 0,07±0,01 $^{cA}$ |
| S1.5 | 0,06±0,00 $^{bA}$ | 0,06±0,00 $^{cA}$ | 0,06±0,00 $^{cA}$ | 0,06±0,00 $^{cA}$ |

Mean±SD. Different lowercase letters in columns and capital letter in rows indicate significant differences (p<0.05).

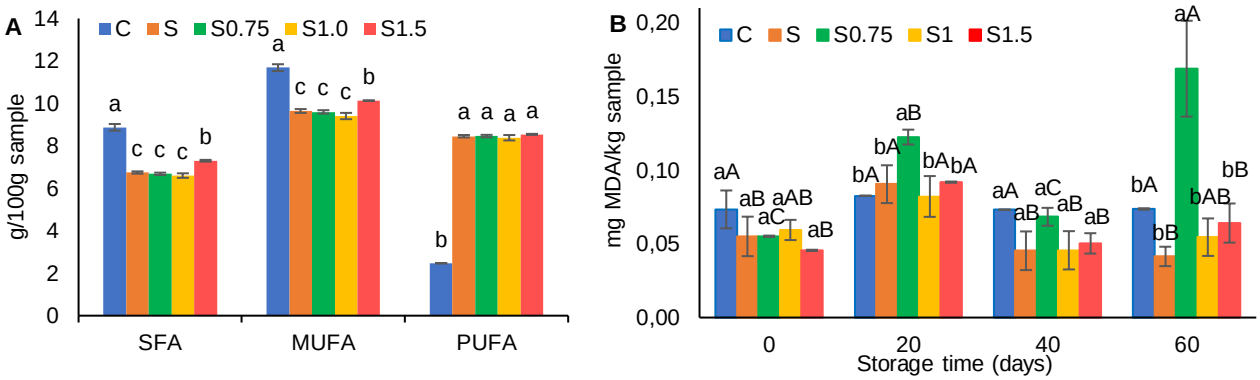


Figure 1. SFA, MUFA and PUFA contents (A) and lipid oxidation (TBARS value) (B) of frankfurters. Different lowercase letters among treatments and capital letters among storage times indicate significant differences (p<0.05).

## IV. CONCLUSION

This study demonstrated that substituting pork fat with soybean oil improved the lipid profile of the frankfurters. Sausages with shiitake stipe extract exhibited lower antioxidant capacity than those with sodium erythorbate. However, despite this, shiitake stipe extract, at concentrations starting from 1%, functioned similarly to sodium erythorbate in delaying lipid oxidation of the samples, indicating great potential as a viable strategy for replacing this commercial antioxidant in frankfurters with soybean oil as a substitute for animal fat.


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