

## Stabilized White Grape Pomace as a Natural Preservative in Frankfurt-Type Sausages: The Effects on Microbial Growth, Oxidation, and Color Stability

María Jesús Martín-Mateos<sup>1</sup>, María Díaz-Ponce<sup>1</sup>, Miriam Sánchez-Ordóñez<sup>1</sup>, Jonathan Delgado-Adámez<sup>1</sup>, Beatriz Toro-Hernández<sup>1</sup>, M. Rosario Ramírez-Bernabé<sup>1</sup>

<sup>1</sup>INTAEX-Centro de Investigaciones Científicas y Tecnológicas de Extremadura, Badajoz, Spain (\*mariajesus.martinmat@juntaex.es)

### INTRODUCTION & AIM

The main by-product of winemaking is grape pomace, which is a mixture of seeds, stems, skins, stalks and pulp remains. Its main use is distillation to obtain ethanol. However, grape pomace contains very interesting compounds such as fibre, proteins, fat and phenolic compounds, which presents antimicrobial and antioxidant activity. Moreover, bioactive compounds from grape pomace has many positive effects for health decreasing the risk of suffering some degenerative diseases.

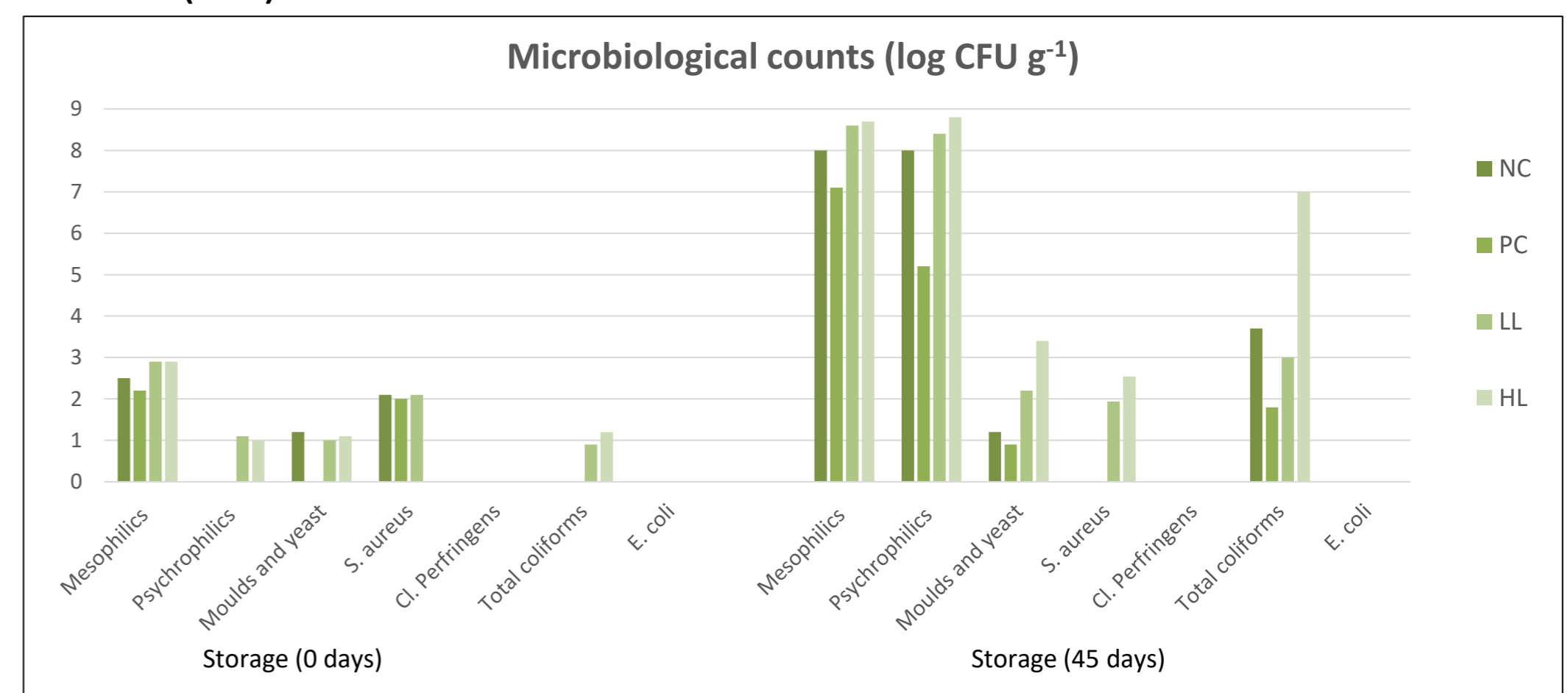
Frankfurter-type sausages are one of the most widely consumed meat products. It is a non-fermented emulsified meat product manufactured by the addition of nitrites, a curing salt which is actively involved in the formation of the typical pink colour of frankfurter sausages. The addition of nitrites also confers antimicrobial and antioxidant activity by protecting lipids from rancidity and generates flavour and aroma in the cured products. However, the use of nitrites and nitrates has undesirable toxicological effects as they are related to the incidence of some types of cancer. Therefore, the main objective of this study was to evaluate the application of an ingredient obtained from an integral valorization process of white grape pomace in order to improve the preservation of pork frankfurters and use it as a substituent of nitrifying salts

### METHOD

White grape pomace (cv Cayetana) was stabilized by means of thermal blanching by applying steam at 103°C (to inactivate the polyphenol oxidase enzyme) and high hydrostatic pressure at 600MPa for 5 minutes (with the aim of reducing the initial microbial loads while preserving the phenolic compound content) to obtain an ingredient for food products preservation. Processing conditions were chosen in basis of previous studies which showed that the product could reach long time of stability after processing. The valorized ingredient (WGP) was added to the formulation of Frankfurt-type sausages. A conventional formula was followed to prepare the frankfurters: pork meat (40% w/w), pork fat (40% w/w), and ice (20% w/w). Pork meat and fat was acquired in a local market. Four formulations were evaluated: Negative Control (NC: with conventional formulation, without white grape pomace and without sodium ascorbate and nitrites), Positive Control (PC: with sodium ascorbate (0.5 g kg<sup>-1</sup>) and sodium nitrite (0.15 g kg<sup>-1</sup>), Low Level (LL: with 0.5% WGP and without sodium ascorbate and nitrites) and High Level (HL: with 3% WGP and without sodium ascorbate and nitrites). All was mixed until a fine paste was obtained and stuffed into a collagen edible casing of 15 mm of diameter. Then the sausages were cooked a Rational oven (Combimaster Plus) at 82°C and 85% of humidity for 15-20 minutes (until the internal temperature of the sausage reached 72°C). Immediately, the frankfurters were refrigerated, vacuum-packaged, and stored at +5°C in darkness for 45 days. Microbiological, instrumental color and oxidative stability (lipid and protein oxidation) were analyzed.

### RESULTS & DISCUSSION

The addition of synthetic additives or grape pomace did not affect the initial counts of control group, so that it did not produce any advantage. Also, neither nitrites nor WGP were able to prevent microbial growth in the sausages throughout the storage period. The highest counts were observed when pomace was added at high levels (3%).



The use of nitrites provided and initial pink colour and prevented the discoloration of sausages during storage, while WGP only showed an effect when added at higher levels. Both nitrites and WGP were effective in reducing lipid oxidation of the sausages during the manufacture process and the refrigerated storage. However, only WGP limited protein oxidation development during storage, while nitrites showed the opposite effect.

	Storage (days)	NC	PC	LL	HL	Signification
L*	0	71,5a ± 1,1	66,7c ± 0,9	68,6b ± 1,7	66,3c ± 0,7	***
	50	72,5a ± 0,9	67,4c ± 1,2	69,5b ± 0,7	66,5c ± 0,8	***
	<i>p-storage</i>	ns	ns	ns	ns	
a*	0	1,5c ± 0,1	8,4a ± 0,4	1,7c ± 0,0	2,7b ± 0,1	***
	50	1,7d ± 0,2	8,2a ± 0,5	2,2c ± 0,2	2,8b ± 0,1	***
	<i>p-storage</i>	**	ns	***	ns	
b*	0	14,3a ± 0,1	9,9d ± 0,2	12,9c ± 0,3	13,7b ± 0,1	***
	50	14,0a ± 0,3	10,1d ± 0,2	12,7c ± 0,1	13,5b ± 0,3	***
	<i>p-storage</i>	ns	ns	ns	ns	
Chroma	0	14,4a ± 0,1	13,0c ± 0,4	13,0c ± 0,3	13,9b ± 0,1	***
	50	14,1a ± 0,3	13,1b ± 0,3	12,9b ± 0,1	13,8a ± 0,3	***
	<i>p-storage</i>	ns	ns	ns	ns	
Hue	0	84,2a ± 0,3	49,7d ± 0,9	82,6b ± 0,1	78,9c ± 0,2	***
	50	83,0a ± 0,7	51,0d ± 2,0	80,3b ± 0,9	78,1c ± 0,8	***
	<i>p-storage</i>	**	ns	***	ns	
Lipid oxidation (mg MDA/kg)	0	0,6a ± 0,1	0,0b ± 0,0	0,2b ± 0,0	0,1b ± 0,0	***
	50	0,6a ± 0,0	0,1d ± 0,1	0,4b ± 0,0	0,2c ± 0,0	***
	<i>p-storage</i>	***	ns	***	***	
Protein oxidation (nmoles carbonils/mg prot)	0	2,5a ± 0,5	2,3a ± 0,2	1,7b ± 0,4	1,5b ± 0,2	**
	50	1,8b ± 0,3	5,6a ± 0,6	2,5b ± 1,0	2,2b ± 0,5	***
	<i>p-storage</i>	*	***	ns	*	

### CONCLUSION

The incorporation of WGP in the frankfurter formulation was effective in reducing lipid and protein oxidation during processing and storage, and an addition of 3% WGP also maintained stable color parameters, but WGP showed no antimicrobial effect.

### ACKNOWLEDGEMENTS

This study has been financed by ERDF and Junta de Extremadura by the Project with title: Valorización de los subproductos de la industria enológica mediante tecnologías alternativas a las convencionales para mejorar la conservación de los productos cárnicos (IB20073).