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# EFFECT OF ADDITON OF SUNFLOWER AND MAIZE CROP RESIDUE EXTRACT ON PHYSICOCHEMICAL AND MICROBIAL PROPERTIES OF PORK LIVER PÂTÉ

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## I. INTRODUCTION

Modern agriculture produces a large amount of residue every year causing environmental pollution due to limited and inadequate agricultural waste management [1]. Previous research has shown that agro-industrial residues are important sources of various bioactive, mainly phenolic, compounds that could be applied in the meat industry as natural antimicrobials and antioxidants [2]. This study aimed to assess the effect of the addition of sunflower and maize crop residue extracts on physicochemical (pH and colour) characteristics and microbiological quality of pork liver pâtés over three months of storage and compared to a synthetic antioxidant (butylated hydroxytoluene - BHT) and a control batch.

## II. MATERIALS AND METHODS

Sunflower and maize residue ethanolic extracts were obtained from stalks collected after the harvest time between July and October 2021. The plant material first was extracted with a six-fold weight of hexane for 1 h at 40 °C, followed by filtration and evaporation, after which the process was repeated using 96% ethanol under the same working conditions. In this study, four formulations of pork liver pâtés were prepared: CON (without extract), BHT (0.2 g/kg butylated hydroxytoluene added), SSRE (10 g/kg sunflower stalk residue extract added) and MSRE (10 g/kg maize stalk residue extract added). All the groups were based on an identical recipe, except for the addition of different antioxidants, and included the following ingredients (g/1000 g): 330 g pork liver, 300 g pork backfat, 206 g lean meat, 125 g water, 15 g soy protein isolate, 16 g curing salt (0.6% nitrite in NaCl), 5 g sodium tripolyphosphate and 3 g spice mix. After the comminution of the main ingredients, the additives and extracts dissolved in water were added (in the corresponding batch) and mixed in a cutter until a homogeneous mixture. Raw pâté batters were placed in plastic containers (100 g) and cooked by immersion in a hot water bath at 80 °C for 30 min. The pâtés were cooled and stored at 4 ± 1 °C over a period of 90 days. Batches were made in triplicate. At the beginning of the experiment, (d 0) and at the end of storage (d 90), pâtés were evaluated by instrumentally measuring pH using a Testo 205 (Testo AG, Lenzkirch, Germany) with a glass electrode for penetration and colour (according to CIE L\*a\*b\*) with a portable colourimeter (NR110, 3NH Technology Co., Ltd, China). The L\* (lightness), a\* (redness) and b\* (yellowness) values were recorded after 30 min of blooming time. For determination of total viable count (TVC), 10 g of the pâté were blended with 90 mL sterile buffered peptone water (Oxoid®, UK), then appropriate decimal dilutions were pour-plated on the plate count agar (Oxoid®, UK) and incubated at 30 °C for 72 h. Obtained results were expressed as a log CFU/g. Data were analysed using a General Linear Mixed Model (GLMM), considering the treatment and time as a fixed effect and the replicates as a random effect. The intergroup comparisons were appraised by one-way analysis of variance (ANOVA) followed by Tukey's tests (difference considered significant if P<0.05).

### III. RESULTS

At the beginning of the experiment, the addition of sunflower extract significantly reduced lightness, while maize extract decreased redness and increased yellowness in pork liver pâtés. After 3 months of storage, SSRE pâtés had the lowest L\* and the highest a\* values, while the b\* value was significantly higher in both pâté formulations with extracts compared to the control. Over storage time, pâtés made with sunflower and maize extracts became significantly redder and yellower. Elaboration with 1% crop residue extracts decreased the pH values in pork liver pâtés for both examination periods (P<0.0001) (Table 1).

Table 1 Physicochemical properties of pork liver pâtés on day 0 and day 90 of refrigerated storage

Days of storage	Parameters	Groups				SEM	P value
		CON	BHT	SSRE	MSRE		
0	L*	56.1 <sup>aA</sup>	53.7 <sup>a</sup>	50.9 <sup>b</sup>	55.9 <sup>a</sup>	1.46	<0.0001
	a*	12.4 <sup>a</sup>	13.2 <sup>b</sup>	12.9 <sup>aA</sup>	11.2 <sup>cA</sup>	0.41	<0.0001
	b*	12.2 <sup>a</sup>	12.6 <sup>aA</sup>	11.9 <sup>aA</sup>	14.1 <sup>bA</sup>	0.41	<0.0001
	pH	6.5 <sup>a</sup>	6.5 <sup>bA</sup>	6.4 <sup>c</sup>	6.4 <sup>cA</sup>	0.01	<0.0001
90	L*	59.4 <sup>aB</sup>	55.1 <sup>b</sup>	51.5 <sup>c</sup>	55.6 <sup>b</sup>	1.17	<0.0001
	a*	12.5 <sup>a</sup>	13.7 <sup>b</sup>	14.8 <sup>cB</sup>	12.1 <sup>aB</sup>	0.23	<0.0001
	b*	12.7 <sup>a</sup>	13.8 <sup>bB</sup>	14.3 <sup>bB</sup>	15.9 <sup>cB</sup>	0.36	<0.0001
	pH	6.5 <sup>a</sup>	6.5 <sup>bB</sup>	6.4 <sup>c</sup>	6.4 <sup>dB</sup>	0.01	<0.0001
Time	P value	<0.0001	<0.0001	<0.0001	<0.0001		

<sup>a,b,c</sup> Within a row, means with a different superscript differ at P<0.05; <sup>A,B</sup> Within a column, means with a different superscript differ at P<0.05; CON- control pâtés; BHT- pâtés with 0.02% butylated hydroxytoluene added; SSRE- pâtés with 1% sunflower residue extract added; MSRE- pâtés with 1% maize residue extract added; SEM- standard error of the mean.

On d. 0 of the experiment in pâtés made with sunflower and maize crop residue extracts TVC count was lower (1.47 and 1.55 log CFU/g, respectively) in comparison with the control (1.80 log CFU/g) and BHT group (1.75 log CFU/g) (P<0.0001). The same difference in TVC count was maintained until the end of storage, where pâtés with extracts had a TVC below 5 log CFU/g, while in the control and BHT group TVC count of 5.05 and 5.11 log CFU/g was observed.

### IV. CONCLUSION

The sunflower and maize crop ethanolic extracts improved the microbial quality of the pork liver pâtés indicating the potential of these extracts as natural preservatives in meat products. However, the addition of 1% of crop extracts resulted in a darker product with a higher b\* value, especially after 3 months of storage.

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