POLYPHENOL CONTENT AND ANTIMICROBIAL ACTIVITY OF *PLEUROTUS PULMONARIUS* MYCELIUM ON MEAT HOMOGENATES

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I. INTRODUCTION

Meat and meat products are important sources of protein and fat associated with their technological and sensorial attributes. However, this composition contributes to the growth of spoilage bacteria, resulting in quality, acceptability, and safety losses. Thus, antibacterial additives like nitrites and nitrates, among others, have been used by meat processors to reduce the aforementioned undesirable effects [1]. However, human health risks has been associated with its uncontrolled use; thus, natural antimicrobials are a potential alternative to reduce pathogen growth and meat quality loss [1,2]. Therefore, the aim of the present work was to evaluate the effect of *P. pulmonarius* mycelium on growth of four important foodborne pathogenic bacteria in pork meat homogenates.

II. MATERIALS AND METHODS

Mycelium was grown under submerged fermentation (150 rpm/29 °C/10 d/under dark) using a medium composed of glucose (20 g/L), yeast extract (5 g/L), KH_2PO_4 (1 g/L), $MgSO_4$ $7H_2O$ (0.5 g/L), and ascorbic acid (0.05 g/L). The medium (100 mL) was inoculated with mycelium (1 cm^2 of covered surface in PDA). Treatments were as follows: CN(-), medium without mycelium at 200 ppm; CN(+), antibiotic at 50 ppm, T1 and T2, mycelium at 100 and 200 ppm, respectively). Total phenolic (TPC) and chlorogenic acid (CGA) contents, and the antimicrobial effects against foodborne pathogens were assessed. Gentamicin was used as a positive control [3]. Also, an aqueous pork meat homogenate (m. *Semimembranosus*, 1:10 ratio) was treated with the antimicrobials and their effectivity tested [3,4]. Obtained data (n=6) were subjected to ANOVA and Tukey-Kramer's tests at $P<0.05$ (NCSSv11).

III. RESULTS AND DISCUSSION

Results in Table 1 indicate that T2 showed the highest ($P<0.05$) TPC and CGA values. Also, CN (+) showed the highest ($P<0.05$) bacteria inhibition; however, T2 exerted the highest pathogenic bacteria inhibition (*E. coli* > *L. monocytogenes* > *S. typhimurium* > *S. aureus*) concerning CN (-).

Table 1. Polyphenols and antimicrobial activity of *P. pulmonarius* mycelium.

Treatments	TPC	CGA	Gram-positive (O.D. 620 nm)		Gram-negative (O.D. 620 nm)	
	(mg GAE/mL)	(mg CGA/mL)	*S. aureus*	*L. monocytogenes*	*E. coli*	*S. typhimurium*
CN (-)	-	-	0.81^{d}	0.84^{d}	0.55^{d}	0.86^{d}
CN (+)	-	-	0.15^{a}	0.15^{a}	0.10^{a}	0.15^{a}
T1	3.35^{a}	35.50^{a}	0.75^{c}	0.67^{c}	0.42^{c}	0.71^{c}
T2	4.58^{b}	45.27^{b}	0.70^{b}	0.60^{b}	0.34^{b}	0.64^{b}
SEM	0.089	0.249	0.003	0.003	0.005	0.004
P-value	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Results expressed as mean ± SD. Different superscript letters within a column indicate differences between treatments (P<0.05).

Phenolic compounds are secondary metabolites widely found in agro-industrial residue extracts, which can be used as functional ingredients [2]. In agreement, it has been reported that a natural extract obtained from fermented agro-industrial residues added with fungi mycelium exerts antioxidant activity related to the release of bioactive compounds [3]. Furthermore, our results also indicate (Table 2) that the inclusion of *P*. *pulmonarius* mycelium into meat homogenates reduced pH and psychrophilic bacteria values, and concomitantly increased TPC and CGA values in concentration dependence.

Table 2. Effect of *P. pulmonarius* mycelium on meat homogenates microbial growth (log_{10} CFU/g).

Treatments	pH	TPC (mg GAE/mL)	CGA (mg CGA/mL)	Mesophilic (log_{10} CFU/g)	Psychrophilic (log_{10} CFU/g)
CN (-)	6.04^{b}	ND	ND	3.62^{b}	3.97^{c}
CN (+)	6.04^{b}	ND	ND	3.41^{a}	3.49^{a}
T1	5.98^{a}	0.47^{a}	5.52^{a}	3.62^{b}	4.02^{c}
T2	5.97^{a}	0.83^{b}	8.90^{b}	3.63^{b}	3.70^{b}
SEM	0.008	0.022	0.121	0.027	0.045
P-value	<0.001	<0.001	<0.001	<0.001	<0.001

Results expressed as mean ± SD. Different superscript letters within a column indicate differences between treatments (P<0.05).

Using natural extracts in processed meat products has always been considered a potential strategy to reduce meat quality loss [1,2]. However, investigations on the use of extracts obtained by fungal fermentation and their use as additives for meat products are still limited. A microbial growth reduction in pork meat treated with edible mushrooms has been reported [4]. Also, the antimicrobial *in vitro* activity of *Pleurotus sp.* mycelium against *E*. *coli* has been demonstrated, although a minor effect was observed against *Pseudomonas aeruginosa*, *Listeria innocua,* and *S*. *aureus* [5].

IV. CONCLUSION

P. *pulmonarius* mycelium extract is an alternaive source of polyphenols and possesses antimicrobial properties in concentration dependence. These findings highlight the potential usage of mushroom mycelium as an antibacterial additive for meat and meat products.

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