Antimicrobial effect of Agaricus blazei extract on - patties during chilled storage

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Introduction: Microbial growth is a significant cause of chemical spoilage in meat and meat products during processing, storage, and distribution. To avoid or delay microbial growth, some synthetic chemical compounds are commonly used as antimicrobial food preservatives (Aziz & Karboune 2018). However, health risks have been associated with the extensive use of these additives resulting in strict regulations over their use in foods. Accordingly, there is a strong argument for the search of natural antimicrobial compounds as an alternative to prevent microbial growth and deterioration of foods (Aziz & Karboune 2018; Molognoni et al., 2019). Thus, the objective of the present study was to determine the effectiveness of *Agaricus blazei* aqueous-ethanol extract (ABE) against microbial growth of raw and cooked pork patties subjected to chilled storage for 9 days.

Materials and methods: Total phenolic content (TPHC) and antimicrobial effect of ABE against pathogenic bacteria (*Staphylococcus aureus* ATCC 29213B and *Escherichia coli* ATCC 25922) were assessed. Antibiotic gentamicin was used as positive control. In each of two replicates, 36 patties (45 g each) were formulated 24 h *postmortem* with pork (*M. semimembranosus,* 83.5%), fat (10%), salt (1.5%) and water (5%). Treatments consisted in the addition of ABE (0 and 1.0%; control and T1, respectively) and Butylated hydroxytoluene (BHT, 0.02% fat basis) (T2). In experiment I, 18 formed patties (6 per treatment) were individually packaged in polypropylene trays and wrapped with polyvinyl chloride film (17,400 cm^3 O_2/m^2/24 h at 23 °C). In experiment II, 18 formed patties (6 per treatment) were cooked in a preheated grill at 180 °C (George Foreman®, USA), until an internal temperature of 70 °C was reached, and individually packaged. All patties were subjected to refrigerated storage at 2 °C in dark for 0 and 9 days, and three packages from each formulation were opened for subsequent tests of TPHC, pH and microbial growth (mesophilic and psychrotrophic counts) (Huang et al., 2011; Jorgensen & Turnidge, 2015; NOM, 1994). Data were subjected to ANOVA and means were compared by the Tukey-Kramer test ($p<0.05$) using the statistical packaged NCSSv11.

Results: The presence of phenolic compounds was confirmed in ABE (63.1 ± 0.5 mg GAE/g), and according to the antimicrobial test, ABE exerts significant ($p<0.05$) antibacterial effect against *S. aureus* and *E. coli* (IC_{50} = 119.0 and 540.0 µg/mL, respectively). Results of the positive control (gentamicin) showed IC_{50} values <100 µg/mL ($p<0.05$). These results agree with previous findings on the antimicrobial properties of edible mushrooms extracts and support the relationship between their phenolic content and the observed antibacterial activity (Erdoğan, 2021). At the end of storage (day 9), the incorporation of ABE (T1) to raw and cooked pork patties significantly ($p<0.05$) increased TPHC (70.4 and 52.9%, respectively), and pH values (83.3 and 50.7%, respectively), when compared with the control and T2. Furthermore, the incorporation of ABE (T1) to raw and cooked pork patties significantly ($p<0.05$) decreased the mesophilic (approx. 1.2 and 0.4 log^{10} CFU/g, respectively) and pyschrotrophic counts (approx. 1.0 log^{10} CFU/g by broth), when compared with the control and T2. In this context, antimicrobial effect of mushroom extracts has been related with the inhibition of DNA and protein synthesis, and permeability disruption of bacterial cell membrane (Aziz & Karboune 2018; Molognoni et al., 2019; Erdoğan, 2021).

Conclusions: The present results highlight the potential usage of ABE as an antibacterial additive during chilled storage of raw and cooked pork patties.

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