Application of pine bark extracts on ready-to-eat smoked pork belly: effects on lipid oxidation and antioxidant capacity

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Background:

Natural foods with increased nutritional content and additional biological and health benefits are appealing to modern customers. A growing interest in using natural substances to replace synthetic compounds in foods has sparked several thorough studies with plant-origin products. Maritime pine bark (*Pinus pinaster* subsp. *atlantica*) is an abundant waste from the timber industry and an important source of natural polyphenolic compounds. These compounds stand out due to their bioactive potential, especially antioxidant and antimicrobial activities, that can be used for preserving foods, increasing their shelf life, safety, nutritional value, as well as reducing food waste. The present work aims to evaluate the efficiency of pine bark extracts for reducing lipid oxidation in a ready-to-eat cured-smoked pork belly product.

Materials and Methods:

Pine bark liquid extracts (PBE), obtained by microwave-assisted extraction (1600 W and 130 ºC for 15 min.) using a water-ethanol solution, were filtered and stored at 4 ºC in hermetic glass flasks. Four batches of cured-smoked pork belly (BM, BE, BP, BC) were produced in collaboration with a meat processing company. PBE (0.2 mg/g) was applied by brushing on the sample's surfaces. This PBE concentration was chosen after evaluation of toxicity with Caco cells lines (data not shown). Before thermal processing (hot smoking- 70º C), PBE and a mix of red wine, salt and spices (a brine seasoning recipe, without chemical additives) were added to BM samples, while only PBE was added to BE samples. For BP samples, PBE was added after the smoking process was completed. A control sample (BC) was produced with no extract addition. Samples were vacuum-packed and stored at 4 ºC before analysis. Lipid oxidation (TBARS, acidity, peroxide value), total phenolic compounds (TPC), and antioxidant activity (DPPH and ORAC) were measured 10 days after the processing conclusion. The statistical significance level was set to $p<0.05$ to discuss the results.

Results:

Collected data showed that PBE application delayed lipid oxidation: TBARS and acidity values (AV) were higher in the BC sample (6.07±0.04 mg/g; 3.48±0.05%, respectively).

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The lowest values were found in samples brushed before smoking (BM: 3.91±0.08 mg/g for TBARS and 1.30±0.25% for AV; BE: 3.14±0.02 mg/g for TBARS and 1.47±0.05% for AV). BP presented the highest peroxide value (31.65±4.29 meq/kg) and BM the lowest (18.07±0.07 meq/kg). TPC, DPPH and ORAC values were significantly higher in BP: 1.41±0.13 mg/g; 0.61±0.00 mg.eq Trolox/g; 10.49±0.40 mg.eq Trolox/g, respectively. BM samples revealed the lowest DPPH values (0.25±0.01 mg.eq Trolox/g). No differences were found between BC, BM, and BE samples regarding TPC and ORAC values.

Conclusions:

PBE addition delayed lipid oxidation, especially when applied before thermal treatment (BM and BE samples), revealing the potential to extend the shelf life of these cured-smoked pork products. On the other hand, PBE application after thermal treatment (BP sample) presented the highest total phenolic content and the highest antioxidant capacity, revealing the potential bioavailability of these meat products. Applying natural bioactive compounds, extracted from maritime pine-bark, to ready-to- eat cured-smoked meat products is an opportunity to develop safe and sustainable meat products, reducing food waste and valorizing underexploited forestry by-products.

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