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Pork patties enriched with vegetal ingredients to enhance health benefits for consumers

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Abstract

The aim of this study was to improve pork patties from *Porc Negre Mallorquí* (PNM, Majorcan Black Pig), with vegetal ingredients. This is an endangered autochthonous breed from Mallorca Island. The objective was to have high sensory quality products, with enhanced health benefits for consumers. To achieve this, bioactive compounds such as polyphenols and beta-glucans, present in the bilberries and mushrooms added to the patties, were determined. Five types of patties (120 g) were prepared: Control (C) PNM meat, (T1) adding shiitake mushrooms, (T2) adding porcini mushrooms, (T3) adding dehydrated bilberries plus extract, and (T4) adding dehydrated bilberries. Total amount of polyphenols from the bilberries and percentage of β-glucans in the mushrooms were determined. The bioactive compounds present in the innovative patties with respect to the control ones were 28.6 mg and 17.8 mg of total polyphenols in T3 and T4; 0.36 g and 0.28 g of beta-glucans in T1 and T2. Sensory acceptability scores were between 3 (not like nor dislike) and 4 (like). Further studies are required in order to ascertain the types of polyphenols present in the different treatments and the specific benefits for consumers.

Introduction

The Black Majorcan Pig is as an autochthonous endangered extensive pig breed of the Mediterranean area (González et al., 2013). Their feeding regime is based on pasture grass, cereals, legume seeds, figs, almonds, acorns, and several Mediterranean shrubs. Additionally, for meat production the animals are supplemented with barley and green peas.

The main product made from PNM meat is the *sobrassada*, a type of dry spiced fermented sausage with paprika and with a high fat content. However, innovations to maintain or try to expand the market share and availability of traditional pork products from this breed are needed.

Polyphenols are a large and heterogeneous group of phytochemicals containing phenol rings (Hanhineva et al., 2010). They may act as antioxidants by scavenging radicals that include superoxide anion, hydroxyl radical, lipid peroxyl radicals, etc. Several hundred different polyphenols are found in plant-based foods including vegetables (particularly, broccoli, onion and cabbage), fruits (grapes, pears, apples, cherries and various berries contain up to 200–300 mg polyphenols per 100 g fresh weight), legumes (soybean), cereals, plant-derived beverages and chocolate (Pandey et al., 2009; Scalbert et al., 2005; Xiao et al., 2015).

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Poliphenols may improve safety during meat storage and protect against carcinogen compounds formed during heating (Jensen et al., 2016). Polyphenol-rich berries may reduce sucrose digestion and absorption leading to delayed glycemic response (Torronen et al., 2013).

Beta-glucans are glucose polymers units per glycoside compounds and located on the cell wall of mushrooms, yeasts and cereals. Those derived from mushrooms are bound by 1-3 and 1-6 glycosidic bounds, and are different from the beta-glucans of cereals, which are characterized by 1-3 and 1-4 bounds. For this reason their biological properties are not exactly the same: the beta-D-glucans from mushrooms have immunomodulatory and anti-cancer properties (Rop et al., 2009). It has also been described that beta-glucans can decrease the levels of lipids in blood by increasing the viscosity of the aliments and decreasing the fat absorption (Cheung, P.C., 1998; Rop et al., 2009; Schneider et al., 2011).

Materials and Methods

Composition and preparation of the patties

Five types of patties were prepared using the meat of hams and shoulders from PNM. Two deboned hams and shoulders were frozen at -18ºC, 72 hours after slaughter, and stored in these conditions until use.

On the day of the assay the hams and shoulders were minced together (with 4mm-diameter cutting disks) at a core temperature of -1.5 ºC. Then, minced meat was divided into five different batches (one for each type of patty) totalling 1kg of final product per batch.

The patties were prepared using a commercial recipe basis with 18 g NaCl, 0.3 g sulphite, 0.5 ascorbic acid and 100 mL pasteurized eggs per kg meat to improve shelf life and texture. Apart from these common ingredients, the five batches included per kg of meat: Control (C) no addition, (T1) 10 g of dehydrated shiitake mushrooms, (T2) 10 g of dehydrated porcini mushrooms, (T3) 10 g of dehydrated bilberries plus 10 g of bilberries extract, (T4) 20 g of dehydrated bilberries.

From each batch, 8 patties of 120g each were prepared.

Determination of beta–glucan content in shiitake and porcini mushrooms

The analysis of beta-glucans in the samples of mushrooms was performed according to the Megazyme kit K-YBGL09/14.

1, 3:1, 6- beta-D-Glucan, 1, 3- beta-D- glucans and α-glucans were solubilized in concentrated hydrochloric acid and then extensively hydrolyzed. Hydrolysis to D-glucose was completed by incubation with a mixture of highly purified exo -1, 3- beta-glucanase and beta-glucosidase. Beta-glucan content was obtained from the difference between total and α-glucans. The results are given in g of beta-glucans/100 g of dehydrated sample.

Analysis of polyphenols from bilberries

The total amount of polyphenols from the bilberries was determined by a colorimetric method using the Folin reagent and gallic acid as standard (Cantin et al., 2009). Results are given in mg gallic acid/g sample.

The two types of bilberries samples used in the study - dehydrated and extract - were analyzed.

Sensory test by trained panel

The patties were cooked on a grill at 200ºC for 5 min per side, with a small amount of olive oil. A six-member trained panel evaluated the samples in a sensory analysis room (ISO8589, 1988) equipped with individual cabins. Samples order was designed to avoid the carry-over effect (Macfie et al., 1989). The attributes evaluated were odour, taste, texture and global acceptability using a 5-point scale.

Results and discussion

Beta-glucans and polyphenols content in patties

Results of glucans analysis in the mushrooms showed that shiitake had significantly higher (P<0. 0001) content of total glucans (33.5%) than porcini mushrooms (27.9%), whereas α-glucans were lower in shiitake (3.6% versus 4.3%). Thus, beta-glucan content was higher in shiitake than in porcini mushrooms (29.9% versus 23.6%).

Regarding the total polyphenols content, a higher amount of polyphenols was found in the bilberry extract (16,4±1,2 mg/g) than in the dehydrated bilberries (7,44±0,52 mg/g).

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According to these results, the content of beta- glucans and polyphenols present in the PNM patties are those shown on Table 1.

Table 1. Content of polyphenols and beta-glucans in PNM patties of 120 g.

	Vegetal ingredient per kg PNM meat	Functional ingredient per patty (120 g)
T1	10 g shiitake	0.36 g beta-glucans
T2	10 g porcini	0.28 g beta-glucans
T3	20 g bilberries*	28.6 mg polyphenols
T4	20 g dehydrated bilberries	17.8 mg polyphenols

*10 g dehydrated bilberries + 10 g bilberries extract

Sensory Evaluation of Patties

The trained panel sensory evaluation (5-point intensity scale) showed that all the attributes for the patties, Control and Treatments, were scored in the range 3.0-4.0, that is "not like nor dislike" and "like", respectively. To better see the differences between treatments, the data on the radar plot are represented in this range (Figure 1).

T2 and T3 patties were the best evaluated and had very similar acceptability regarding odour and taste parameters.

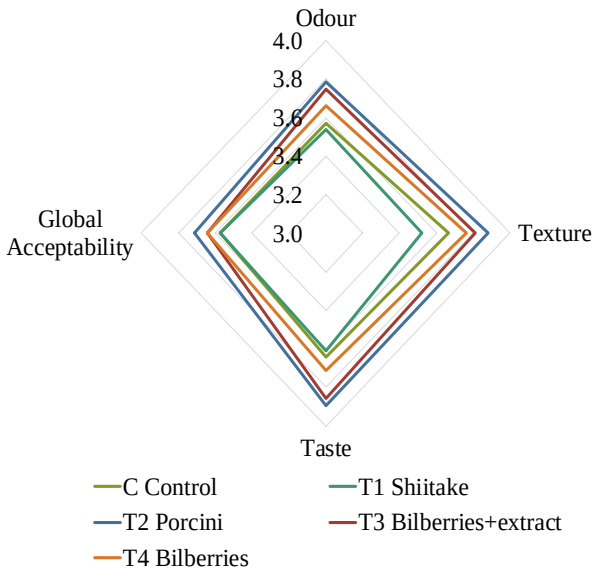

Figure 1 *Sensory evaluation of patties by trained panel.*

Conclusion

Addition of bilberries and mushrooms in the composition of PNM patties resulted respectively in an enrichment of 28.6 mg and 17.8 mg of total polyphenols and of 0.36 g and 0.28 g of beta-glucans with respect to the control. These bioactive compounds may have potential health benefits for the consumers and their inclusion did not affect the sensory acceptability of the patties evaluated by a trained panel.

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