

# CAN LIQUORICE EXTRACT ADMINISTERED AS DIETARY AND/OR AS FEED SUPPLEMENT IMPROVE RABBIT MEAT SHELF-LIFE?

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**Abstract** – Sixty rabbits fed a commercial diet (C) or C diet with 6 g/kg of liquorice extract (L) for 6 weeks. Hindlegs meat of each group was ground, split into two parts, and one was supplemented with 2.5 g/kg of L. Thirty patties/group were obtained (CC; LC; CL; LL). Meat shelf-life study considered pH and microbial count at days 0, 3 and 6. LC and LL supplementation increased pH ( $P<0.001$ ). Total viable count was affected by L inclusion, which was reduced both at day 3 ( $P<0.001$ ) and at day 6 ( $P<0.05$ ). *Pseudomonas* spp. count showed a reduction in LC and LL groups, throughout the shelf-life ( $P<0.001$ ). We conclude that liquorice extract supplementation may help to inhibit rabbit meat bacterial growth.

**Key Words** – *Glycyrrhiza glabra*, hindleg meat patties pH, microbial count

## I. INTRODUCTION

After the EU ban of antibiotics as growth promoters for food-producing animals and due to the growing concerns on the use of synthetic antioxidants to improve the shelf-life of meat and meat products, herbs and spices have been gaining more and more interest as healthy alternatives in animal nutrition and meat processing [1]. Liquorice is an interesting candidate in this sense thanks to its therapeutic properties in improving the immune system and having antiviral, antimicrobial and antioxidant effects [2]. However, no studies assessing its potential to improve the shelf-life of rabbit meat have been conducted until now. Therefore, the present study aimed at studying the effect of *in-vivo* (diet) and *post-mortem* (meat) supplementation with a liquorice root extract on rabbits' meat shelf-life on a 6-day retail display.

## II. MATERIALS AND METHODS

Sixty rabbits were fed with a commercial diet (C) or C diet with 6 g/kg of liquorice extract (L) for 6 weeks. At slaughter, the meat of 15 C and 15 L rabbit hindlegs was separately ground into two batches which were further divided into two parts. One of the two C and the two L meat batches was manually mixed with 2.5 g/kg L and ground again. Thirty patties/group were thus obtained (CC; LC; CL; LL), individually wrapped with plastic and then placed in a fridge at +4 °C and cold fluorescent light illumination for a 6-days shelf-life trial. pH was measured twice on No.=12 patties per treatment, and again on the same patties at days 3 and 6 of refrigerated storage. The remaining 18 patties/treatment were subjected to microbiological analysis (Total Viable Count TVC: ISO 4833:2004; total coliforms: ISO 4831:2006 and 4832:2006; *Pseudomonas* spp.: MI 025 rev 1 2009) at days 0, 3 and 6 of retail display. Two separate one-way ANOVA analyzed the effect of liquorice inclusion and time on the shelf-life data.

## III. RESULTS AND DISCUSSION

The dietary liquorice extract supplementation (LC treatment) lead to significantly ( $P<0.001$ ) higher meat pH at days 0, 3 and 6 of retail display, and the same result was obtained when liquorice extract was added also to the meat patties (LL treatment), when compared to the treatment without supplementation (CC) (Table 1). Considered the higher pH observed on meat from liquorice-supplemented diets and/or meat patties, a significantly higher microbial count was expected. On the contrary, the TVC of the meat measured at day 3 and at day 6 was significantly reduced ( $P<0.001$  and  $P<0.05$ , respectively) by the liquorice extract supplementation (LL treatment). Among the spoiling bacteria, *Pseudomonas* spp. in the meat patties was significantly reduced in treatments LC and LL ( $P<0.001$ ), thus confirming the bacteriostatic action of the liquorice extract reported in literature [3] for the pork meat.

Table 1 Effect of liquorice extract administered as dietary and/or feed supplement on pH values of rabbit hind leg meat patties stored for 6 days under retail display conditions

Liquorice inclusion (L):	Treatment				MSE <sup>1</sup>	Significance Liquorice inclusion
	C	L	C	L		
Diet (6 g/kg)	C	L	C	L		
Meat (2.5 g/kg)	C	C	L	L		
No.	12	12	12	12		
pH:						
Day 0	6.15 <sup>AX</sup>	6.30 <sup>CX</sup>	6.22 <sup>BX</sup>	6.24 <sup>BX</sup>	0.03	***
Day 3	6.25 <sup>AZ</sup>	6.44 <sup>DZ</sup>	6.31 <sup>BY</sup>	6.36 <sup>CZ</sup>	0.02	***
Day 6	6.22 <sup>AY</sup>	6.36 <sup>CY</sup>	6.20 <sup>AX</sup>	6.29 <sup>BY</sup>	0.04	***
MSE	0.03	0.02	0.03	0.03		
Significance Day	***	***	***	***		

<sup>1</sup> MSE = Mean Square Error. <sup>A, B, C, D</sup> Means in a row with different superscripts differ significantly. <sup>X, Y, Z</sup>; Means in a column with different superscripts differ significantly (\*\*\*: P<0.0001).

Table 2 Effect of liquorice extract administered as dietary and/or feed supplement on the microbial count of rabbit hind leg meat patties stored for 6 days under retail display conditions

Liquorice inclusion (L):	Treatment				MSE <sup>1</sup>	Significance Liquorice inclusion
	C	L	C	L		
Diet (6 g/kg)	C	L	C	L		
Meat (2.5 g/kg)	C	C	L	L		
No.	18	18	18	18		
TVC <sup>2,3</sup> :						
Day 0	5.49 <sup>ABX</sup>	4.60 <sup>AX</sup>	5.37 <sup>BX</sup>	5.07 <sup>ABX</sup>	0.30	***
Day 3	6.37 <sup>BY</sup>	6.21 <sup>BY</sup>	7.32 <sup>CY</sup>	5.34 <sup>AX</sup>	0.35	***
Day 6	7.80 <sup>bZ</sup>	7.44 <sup>abZ</sup>	7.35 <sup>abY</sup>	6.90 <sup>aY</sup>	0.49	*
MSE	0.20	0.29	0.53	0.45		
Significance Day	***	***	***	***		
Coliforms <sup>3</sup> :						
Day 0	4.31 <sup>AB</sup>	4.17 <sup>AB</sup>	4.62 <sup>B</sup>	3.80 <sup>A</sup>	0.38	**
Day 3	4.38 <sup>BC</sup>	4.20 <sup>B</sup>	4.61 <sup>C</sup>	3.57 <sup>A</sup>	0.20	***
Day 6	4.47 <sup>ab</sup>	4.11 <sup>ab</sup>	4.66 <sup>b</sup>	3.82 <sup>a</sup>	0.46	*
MSE	0.26	0.40	0.22	0.50		
Significance Day	ns	ns	ns	ns		
<i>Pseudomonas</i> spp. <sup>3</sup> :						
Day 0	5.36 <sup>BX</sup>	4.29 <sup>AX</sup>	5.24 <sup>BX</sup>	4.26 <sup>AX</sup>	0.28	***
Day 3	7.02 <sup>BY</sup>	6.34 <sup>AY</sup>	7.25 <sup>BY</sup>	5.72 <sup>AY</sup>	0.38	***
Day 6	8.10 <sup>BZ</sup>	7.33 <sup>AZ</sup>	7.86 <sup>BZ</sup>	7.46 <sup>AZ</sup>	0.14	***
MSE	0.14	0.46	0.15	0.27		
Significance Day	***	***	***	***		

<sup>1</sup> MSE = Mean Square Error; <sup>A, B, C, D or a, b</sup> Means in a row with different superscripts differ significantly; <sup>X, Y, Z</sup> Means in a column with different superscripts differ significantly (\*\*\*: P<0.0001; \*\*: P<0.001; \*: P<0.05); <sup>2</sup> TVC = Total viable count; <sup>3</sup> Germs count expressed in log<sub>10</sub> CFU/g meat patties.

#### IV. CONCLUSION

Liquorice extract administered as dietary (6 g/kg) and as feed (2.5 g/kg) supplement was able to reduce pathogenic and spoiling bacteria growth in the rabbit meat.

#### REFERENCES

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