NATURAL SOURCES OF POLYPHENOLS AS FEED ADDITIVES TO IMPROVE RABBIT MEAT QUALITY

Linda Saucier[1,2*], Mohamed Z. Abdelwahed[1,2], Amenan P. Koné[1,2] Dany Cinq-Mars[1], Frédéric Guay[1], André Gosselin[3] and Yves Desjardins[2,3]

[1]Department of Animal Science, [2]Institute of Nutrition and Functional Foods, [3]Department of Plant Science, Université Laval, Québec City, G1V 0A6, Canada

*Corresponding author email: linda.saucier@fsaa.ulaval.ca

I. INTRODUCTION

Although mainly consumed in Mediterranean countries, rabbit meat has valuable nutritional properties as it is a source of B vitamins, lean proteins, with a greater proportion of unsaturated fat compared to other more traditional meats [1]. Apart from its renowned prolificacy, feed conversion is above 3, and slaughter weight can be reached in less than 2 months [2]. However, its ultimate pH (pHu) closer to or slightly above 6 makes it more prone to microbial spoilage [3]. Furthermore, the higher content in unsaturated fat increases susceptibility to oxidation. Polyphenols, notably from plant extracts, exhibit antimicrobial and antioxidant properties [4]. So, our hypothesis is that by enriching the diet of rabbit with natural sources of polyphenols, here from onion, cranberry and essential oils, will improve the microbial quality and the oxidative status of rabbit meat during storage at 4 °C.

II. MATERIALS AND METHODS

Animal housing and feeding. A total of 240, 35-day-old weaned Grimaud female rabbits were homogeneously allocated by weight with 6 animals per commercial cages (8 cages, 48 rabbits per group). They received a commercial control diet for one week before the experimental ones were fed, and until they reached a slaughter weight of 2.2 kg. All diets had the same basal ingredients to which plant extracts (onion and cranberry, Nutra Canada Inc., Champlain, Québec, Canada) and essential oils (Xtract™ Instant, Pancosma SA, Geneva, Switzerland) were mixed before cold pelleting (60 °C). The experimental groups consisted of a control 1) not supplemented, 2) + 500 ppm onion extract, 3) + 1000 ppm onion extract, 4) + 500 ppm onion extract + 500 ppm cranberry extract and 5) + 500 ppm onion extract + 100 ppm essential oils. Animals were fed *ad libitum*, weighed and feed intake measured weekly to determine body weight (BW), average daily gain (ADG), average daily feed intake (ADFI) and feed conversion ratio (FCR). Animals were slaughtered in a provincially inspected abattoir after a feed withdrawal of 15 h.

Meat quality measurement. Muscular pH (pH 1 and 24 h *post-mortem*) and meat colour were measured in the *Biceps femoris* (BF) and the *Longissimus lumborum* (LL) as well as drip loss, % exudate lost during cold storage, cooking loss (70 °C, 15 min) in LL. Meat proximate analysis (protein, fat, moisture) and total phenolic content in the feed and in the meat were determined as described in Koné *et al.* [5].

Microbial analysis. Microbial analysis was performed on thighs stored at 4 °C under aerobic (9 d) or anaerobic (20 d) conditions as described in Koné *et al.* [5] to include Aerobic Mesophilic (TAM), presumptive Lactic Acid Bacteria (LAB), presumptive *Pseudomonas*, *Enterobacteriaceae*, coliforms, *Escherichia coli* and presumptive *Staphylococcus aureus* counts.

Lipid and protein oxidation during cold storage. Once the thighs were removed for microbial analysis, the rest of the carcass was deboned and meat was grinded. Trays with ground meat samples were covered with aluminum foil to protect them from light and were stored at 4 °C for 9 d. Lipid oxidation was quantified by measuring thiobarbituric acid reactive substances and protein oxidation by quantifying total carbonyl (kit No. 10005020, Cayman Chemical Company, AnnArbor, MI, US) [5].

Statistical analysis. Data were subjected to an analysis of variance (ANOVA) using the MIXED procedure of SAS (SAS Institute Inc., 2002). Tukey's test was carried out to compare the differences between experimental groups. Significant difference was declared at $P<0.05$.

III. RESULTS AND DISCUSSION

Growth performance, as measured by BW, ADG, ADFI and FCR, were not different amongst the experimental groups (P>0.05). Animals were raised in a research facility with stringent biosecurity measures providing an environment with limited infection pressure. Raw meat composition was not significantly different except for the total phenol content which was higher in the supplemented groups compared to the control (P<0.001). With respect to meat quality attributes, the small variations observed are of limited practical value; pHu was below 6 for both muscles in all groups.

Antimicrobial activity varied with the source of polyphenols, the concentration and combination used as well as with the type of microorganisms to control and the storage conditions; growth was better controlled notably for TAM, presumptive *Pseudomonas* and *Enterobacteriaceae*. The main advantage of the addition of a natural source of polyphenols to the rabbit diet is the improved control over lipid and protein oxidation as demonstrated in Fig. 1.

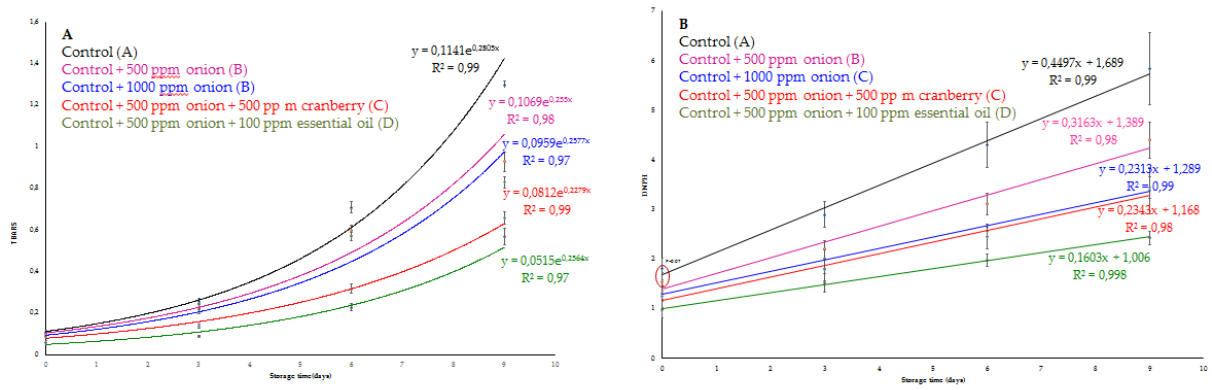

Figure 1. Lipid (A) and protein (B) oxidation as measured by TBARS (MDA mg/kg meat) and total carbonyls (nmol/mg protein), respectively, when ground meat is stored at 4 °C. In the legend, results with different capital letters in parenthesis are significantly different (P<0.05).

IV. CONCLUSION

In our experimental conditions, when onion and cranberry extracts, and essential oils (Xtract^{TM}) were added to rabbit feed as a source of polyphenols, they exhibit a strong antioxidant activity. The antimicrobial activity, although present, was rather moderate and limited to a ≤ 1.29 log reductions at the most.

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