# Microbiological status of *Serpentina* chevon dry aged in bag

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## I. INTRODUCTION

Dry ageing in bag is a *post-mortem* process for increasing the quality of meats, with distinctive flavour, texture, and tenderness characteristics [1], [2]. This process involves the use of packaging bags with a high water vapour transmission rate [1]. Goat meat plays a significant role in the Portuguese diet, typically consumed from fresh meat. During ageing it is essential to rigorously monitor the process conditions to promote the development of desirable sensory characteristics and control the growth of undesirable microorganisms, especially pathogenic bacteria. Previous studies reveal challenges concerning the microbiological safety of aged meat partly due to the absence of specific regulations, further complicating risk assessment and safety assurance [3]. Several studies have highlighted the connection between meat ageing and the potential emergence of microorganisms that cause foodborne illnesses [3], [4], [5], [6]. Therefore, the main objective of this study was to assess the microbiological safety of goat meat dry aged in bag for 46 days, as well as the effects of thermal processing.

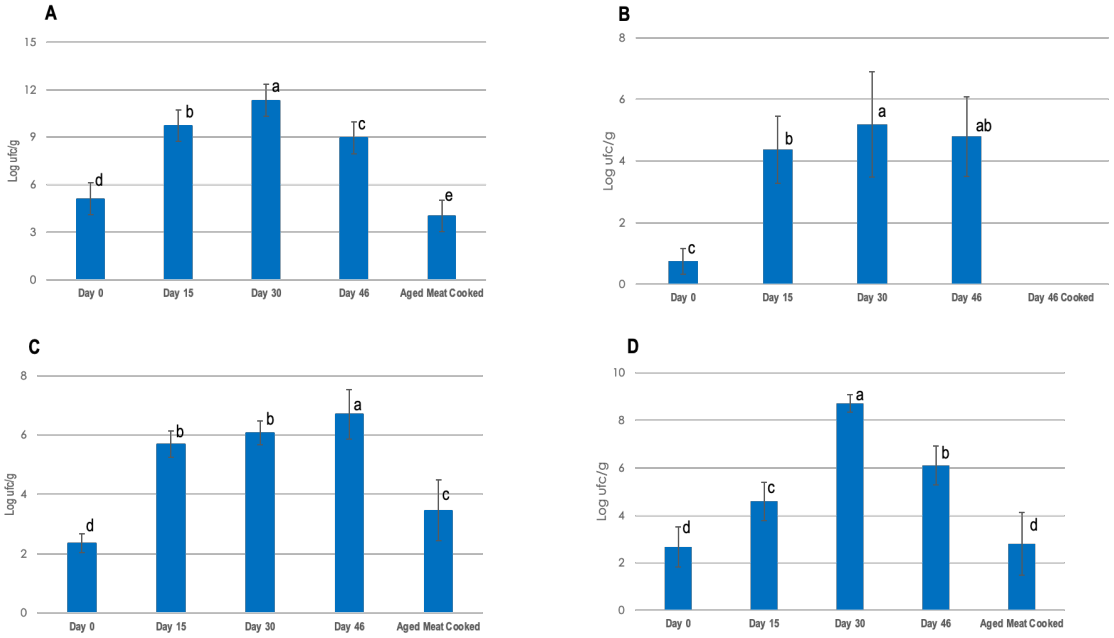
## II. MATERIALS AND METHODS

Five female *Serpentina* goats from the same farm were slaughtered in a commercial abattoir in accordance with the European Commission's regulatory guidelines. The animals were between 8 and 12 years old, with an average final carcass weight of 28.4±4.4kg. On the second day *post-mortem*, the *longissimus thoracis et lumborum* muscle (LTL) was cut from both sides of the carcass and vacuum-packed. On the third day *post-mortem*, the left LTL muscle was packed in bags with OTR permeability (at 23 ºC and 0% RH) of 24 $cm^3/m^2$/24 h; $CO_2$ permeability (at 23 ºC and 0% RH) of 78 $cm^3/m^2$/24 h and MVTR permeability (at 38 ºC and 100% RH) of 44 $g/m^2$/24 h (LID540X, Cryovac®, and allowed to age for 46 days at 2 ± 2 ºC with relative humidity of 60-90%, in the dark, with unfiltered air and protected from UV light. Samples from the right-side LTL muscle were used for microbiological analyses throughout the ageing period (days 0, 15 and 30). This meat was then cooked in a dry oven at 150 ºC until the internal temperature reached 68 ºC. All the microbiological analyses were processed in different culture media and carried out in accordance with the corresponding ISO standards for the following parameters: Total count bacteria, *Escherichia coli* (*E.coli*) count, *Salmonella* spp., *Pseudomonas* spp. count, *Bacillus cereus* count, Mould and Yeast count, and Lactic Acid Bacteria (LAB) count. Microbial results were reported as present or absent for *Salmonella* spp, while counts were expressed in colony-forming units per gram and transformed into log colony-forming units per gram ($log_{10}$ cfu/g) before statistical analysis. The data was analysed in the *RStudio* statistical software (version 4.2.2) using the non-parametric Kruskal Wallis test ($P \leq 0.05$).

## III. RESULTS AND DISCUSSION

The microbiological results are shown in Figure 1 for each microorganism detected in this study. The presence of *Salmonella* spp. was not observed, nor was the proliferation of *Bacillus cereus* and *Pseudomonas* spp.. On the other hand, *E.coli*, moulds and yeasts,

LAB, and total aerobes, were influenced by ageing and thermal processing. It was found that the highest counts of microorganisms were obtained for total aerobes and LAB. In particular, higher microbial counts were recorded on the 30$^{th}$ day of ageing compared to days 0, 15 and 46 for total aerobes, *E.coli* and LAB, unlike moulds and yeasts which showed higher counts on day 46 (Figure 1). Before ageing, the total bacterial count was 5.1 log cfu/g, the *E.coli* count was 0.75 log cfu/g, moulds and yeasts 2.3 log cfu/g and LAB 2.6 log cfu/g. During the ageing period, exponential microbial growth was observed until the 30$^{th}$ day of ageing, followed by a subsequent decline. We highlight that elevated counts during ageing align with the fact that microbiological analyses were conducted on untrimmed meat. The contamination levels obtained reflected the maximum microbial load achievable during ageing, consistent with previous findings indicating high levels of microbial contamination on the surface of aged meat [3]. Importantly, thermal processing (cooking) effectively reduced the microbial load to values below the detection limit (<1 log cfu/g) for *E.coli* count.




1. Figure 1: Microbiological profile of *Serpentina* chevon (A–Total bacteria counts; B–E.coli; C–Moulds and Yeasts; D– 5rrrrrhb7yhu++º’’’’’’’’’’9,,,,p LAB).

The reduction in the total bacterial count on the 46$^{th}$ day of the ageing process can partially be attributed to the competition between microorganisms during ageing process. However, considering the high microbial load of the meat before the beginning of the ageing process and that ageing only began on day 3 post mortem, is it possible that hygienic conditions during slaughter and storage may have led to carcass contamination. Moreover, in a cross-sectional study related with aged products, it was reported that the current knowledge of the microbiological quality and safety of aged meat is still limited, suggesting the need for additional studies to evaluate the safety of these products [7].

## IV. CONCLUSION

The results showed that ageing time led to increasing counts of *E.coli*, total aerobes, LAB and moulds and yeast. Thermal processing reduced the microbial load, being particularly effective for *E.coli*. These results highlight the importance of microbiological control during meat ageing.

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