VACUUM-PACKED BEEF MEATS: ARE THE MICROBIOLOGICAL INDICATORS RELIABLE?

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I. INTRODUCTION

For many years the French meat sector has used microbiological indicators to characterize meat shelf life, in order to have objective references which help in commercial transactions and hygiene production management [1]. Over the years, the bovine meat sector has seen atypical types of preservation profiles amongst vacuum-packed products (muscles and meat). Indeed, there has been an over-development of *Enterobacteriaceae* family, an insufficient development of lactic acid bacteria which are considered as bio-protective for beef meat [2], and even both problems without the meat and muscles showing any sensorial alteration. In order to understand these phenomena and to help the sector to avoid it, the French Livestock Institute and the Caen Normandy University led a study on the identification of microorganisms grown on vacuum-packed meats (ready-to-cut muscles and pieces) after ageing under controlled conditions.

II. MATERIALS AND METHODS

Four different ready-to-cut muscles supplied by 6 industrial producers and 8 different pieces of meat supplied by 4 industrial producers were used in triplicates for ageing tests described in Figure 1.

TVC=Total Viable Count (AFNOR NF V08-011), E=Enterobacteriaceae (AFNOR NF V08-054 at 30°C), LAB=Lactic Acid Bacteria (AFNOR NF V04-503), PB=Psychrotrophic Bacteria (PCA, 22°C, 72h)
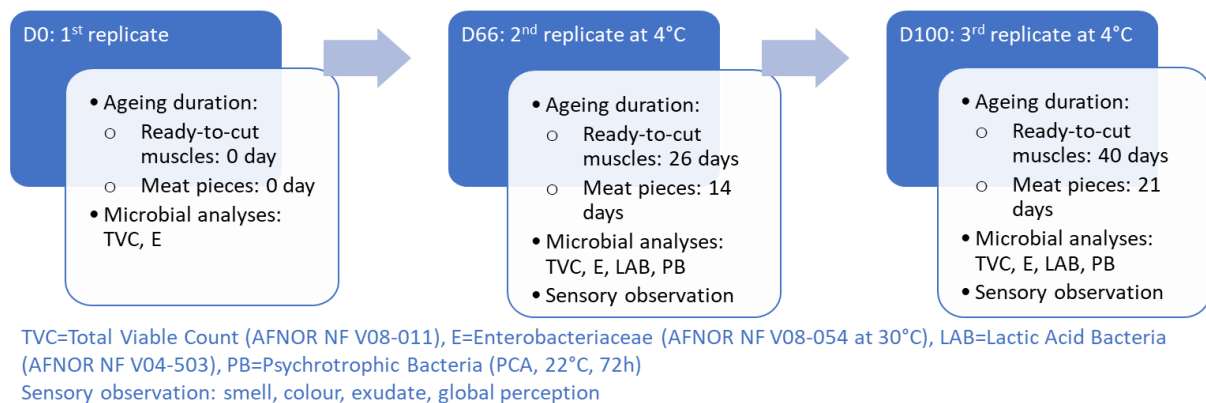Sensory observation: smell, colour, exudate, global perception

Figure 1. Ageing tests and microbial analyses for vacuum-packed beef meats

In total, 138 muscles and 153 pieces of meat were studied, with 90 muscles and 110 pieces aged at D66 and D100 aged stages. Products status after ageing were determined in 3 ranges: compliant products (CP) for both microbial and sensory aspects, non-compliant products (NCP) for sensory aspect, and atypical products (AP) which were compliant for sensory aspect but non-compliant for microbial ones.
474 representative isolates were obtained from agars media and stored at -80°C before being identified by 16S rRNA genes sequencing and comparision with sequences availables in GenBank (http://blast.ncbi.nlm.nih.gov/Blast.cgi) and Ribosomal Database Project (http://rdp.cme.msu.edu/).

III. RESULTS AND DISCUSSION

The 21% of aged muscles and 13% of aged pieces of meat were classified as AP: these meats were unaltered from the sensory observation whereas *Enterobacteriaceae* exceeded the stipulated levels and/or Lactic Acid Bacteria counts were too low to pass the criteria TVC/LAB<100 for high TVC contamination (LAB usually being protective bacteria for vacuum-packed beef meats).

Strain isolated from VRBG (presumed *Enterobacteriaceae*), MRS (presumed LAB) and PCA (TVC) agars were identified after sequencing of 16s rRNA gene. From 474 isolates , 398 could be identified: 238 from AP, 74 from CP and 86 from NCP (CP and NCP being considered as references for usual shelf life of vacuum-packed beef meats). It was shown that a) exceeding VRBG counts were mainly caused by growth of *Hafnia alvei* (37%) and strains very closed to that species (39%), and b) LAB counts were underestimated, due to the exclusion of *Carnobacterium* spp. and *Lactococcus* spp. on MRS agar plates whereas these LAB were particularly present in PCA agars plates (30°C and 22°C) of AP in this study. The lack of representativity of LAB growing on MRS agar have already been observed in previous study dealing selective enumeration medium for *Carnobacterium mataromaticum* [3].

In perspective of this work, a study about an inoculation of *Hafnia alvei* strain on meat product during industrial and consumer storing is currently processing in order to understand the role play by *H. alvei* in the conservation of meat products.

IV. CONCLUSION

These results plead to stop the recourse to *Enterobacteriaceae* counts on VRBG and LAB counts on MRS as microbial indicators to characterise vacuum-packed beef meats shelf life.

ACKNOWLEDGEMENTS

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