EXPLORING BEEF MICROBIAL, PHYSICOCHEMICAL AND SENSORY TRAITS DURING DRY AGEING PROCESS

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I. INTRODUCTION

Today, consumer interest in dry-aged beef is increasing worldwide, creating a strong niche in the foodservice market [1,2]. Butchers have long used the dry ageing process to enhance and preserve the beef quality. In this process, unpackaged primal cuts are selected and aged in a controled environment for several weeks to concentrate the flavour and intensify the beefy flavor. Protein and fat breakdown occurs [1,2], along with water difusion from the interior to surface, which evaporates into the environment, leading to flavour compound concentration [3]. The process guidelines include aging days, storage temperature, RH (61% to 85%) and airflow [1,3]. High RH promotes growth of spoilage microorganisms, creating a viscous surface, while low RH limits bacterial growth and promotes the surface dehydratation and weight loss [1,3]. Meat pH is important during the dry ageing [3]. No legal microbiological criteria exist for dry-aged meat in Europe. The European Food Safety Authority (EFSA) has recently published a scientific opinion on the microbiological safety of dry-aged meat [4]. Bacterial spoilage can occur, e.g. LAB can cause greening of meat and *Pseudomonas* spp. promote off-odours [2,5]. This study aimed to evaluate the occurrence of pathogenic and specific spoilage microorganisms during the dry ageing process of beef and how this affects the acceptability of this product.

II. MATERIALS AND METHODS

Six loins (*L. lumborum)* with same charateristics were selected, divided into three pieces and aged for 90 days in a dry aging room with UV light. On days 1, 7, 14, 21, 35, 60 and 90, samples were analysed for enumeration of aerobic bacteria, *Enterobacteriaceae*, *Pseudomonas* spp., moulds, yeasts; and pathogenic detection according to ISO norms. Color *L*a*b** was determined using a chroma meter. Sensory analysis was performed by an untrained consumer panel (total of 6). The entire sample (crust+meat) and trimmed sample (lean meat) were evaluated, with a score of 0 to 7 (0-absent; 7-high present) for color (red and brown), fresh odour intensity, type of odour and its intensity and the overall acceptability. Data were analysed using SPSS statistical software (SPSS Ver. 27.0; IBM, Chicago, IL, USA), using non parametric analysis – Kruskal-Wallis test with 5% level of significance.

III. RESULTS AND DISCUSSION

The microbiological counts after trimming (lean meat) were significantly lower than the observed in the crust ($P<0.05$) (Table 1), contrarly to the observed in other study [5]. Gowda *et al*. [5] refered high numbers of psychotrophic bacteria, *Enterobacteriaceae*, *Pseudomonas* spp, LAB and yeasts on the surface of beef loins, arriving at >6 $\log_{10}$ CFU/cm^2. One possibility for the lower numbers in this study can be the fact that the dry aged room had UV light continually. On the lean meat, LAB, yeasts and moulds varied significantly ($P<0.05$). As in other studies [4,5], *L. monocytogenes*, *Salmonella* spp. *S.* aureus. and *E. coli* were not detected in all samples. The pH values increased significantly over time ($P<0.05$), indicating a tendency for pH to increase as LAB decreases [4]. Kim *et al*. [6] reported that pH was not influenced by the dry ageing. The *L*, a*, b** values decreased on the crust and the *a** and *b** values decreased on the lean meat

(P<0.05) with an increase of *L** (P>0.05) (Table 1). This means that crust tend to become less luminous, red and yellow and lean meat a little more luminous. In previous studies, dry-aged beef showed lower *L** values due to moisture evaporation, which causes lower reflection of light [3] and a brighter color on dry aged beef [6]. For red color the sensory panel values decreased significatly along the time for both crust with meat and lean meat samples which is consistent with the *a** values. The odour intensity increased over the time for both sample types (P<0.05) and the presence of off-odors were detected at 60 days. Lee *at al.* [7] reported that the surfaces of samples dry aged for up to 63 days became darker and drier. Another study found no significant differences in overall acceptability between non-aged and dry-aged meat [6].

Table 1 Microbiological counts (log_{10}CFU/g), pH, color and overall acceptability values on the crust and lean meat at day 1 and 90 of dry ageing.

Parameters	Meat crust			Lean meat		
	T1	T90	P value	T1	T90	P value
pH	-----	-----	----	5,62	5,97	0,018
Total mesophiles bacteria	5,04	3,15	0,001	4,49	1,15	0,066
Total psychotrophics bacteria	5,38	4,12	0,002	3,91	3,16	0,382
LAB	4,28	2,72	0,023	3,76	0,43	0,002
Enterobacteriaceae spp.	1,06	0,3	0,003	0,17	0,00	0,777
Pseudomonas spp.	4,25	2,59	0,000	3,63	0,43	0,064
Yeasts	4,42	3,19	0,018	3,79	1,59	0,047
Moulds	0,67	1,54	0,000	0,00	1,00	0,002
*L**	73,51	68,6	0,053	32,4	33,2	0,137
*a**	5,83	-0,9	0,003	19,4	15,4	0,002
*b**	16,75	12	0,125	9,25	9,02	0,005
Overall acceptability	6,61	2,33	0,000	6,61	3,43	0,000

IV. CONCLUSION

No pathogens were found up to 90 days of dry ageing and that potential spoilage bacteria were reduced. The lower microbial counts on the lean meat and the overall acceptability assessed by the sensory panel confirm the importance of the good trimming and storage practices for the dry aged beef. Even so further studies are needed to validate the process and to predict the rancidity time limits of the dry aged meat.

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