PE8.31 Shelf-life of Beef Edible Byproducts Stored at 2 °C and 5 °C. 350.00

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Abstract - Edible byproducts from beef are traditionally stored at retailers in vacuum at 2 °C for as long as two weeks after slaughter. When distributed to the consumer, the edible byproducts are usually repacked in smaller servings in plastic trays wrapped in film. These consumer packages are usually given a shelf-life of 4-5 days when stored at 4-5 °C. This study investigates the sensory and microbiological quality at expiry for beef edible byproducts either vacuum packed or consumer packed. In the first part, vacuum packed livers, hearts, tongues and tails were collected the day after slaughter and stored at 2-3 °C for four weeks. The aerobic, psychrotrophic counts (APC) and the sensory quality was determined on a weekly basis. In part two, vacuum packed livers, hearts, tongues and tails were collected the day after slaughter, stored for one week at 2 °C and afterwards repacked and stored at 2 °C and 5 °C, respectively for eight days. On the day of repacking and two, four and eight days after, APC and the sensory quality were determined. The study found an acceptable sensory and microbiological quality of vacuum packed beef edible byproducts after two weeks of storage at 2-3 °C. For consumer packed edible byproducts, acceptable sensory and microbiological quality was found after three to four days of storage at 2 °C and two days of storage at 5 °C. Although no strict correlation between sensory quality and APC was found, the study suggests that counts > 106 cfu/cm2 increase the risk of the edible byproducts having a poor sensory quality.

Index Terms - beef edible byproducts, consumer packed, microbiological quality, sensory quality, shelf-life, vacuum packed.

I. INTRODUCTION

EDIBLE byproducts from beef have traditionally been stored at retailers or caterings in vacuum at 2 °C for as long as two weeks after slaughter. The sensory and microbiological quality after two weeks of storage has not formally been documented in real life studies. When distributed to the consumer at retail level in Denmark, the edible byproducts are traditionally repacked in smaller servings usually in plastic trays wrapped in film. These packages are usually given a shelf-life of 4-5 days when stored at 4-5 °C. Again, data for the sensory and microbiological quality at expiry date are scarce and more data has to be compiled. Thus, a study to investigate the sensory and microbiological quality of vacuum packed and consumer packed edible byproducts, respectively from beef during storage at 2 °C and 5 °C was undertaken.

II. MATERIALS AND METHODS

Two studies were carried out; one regarding shelf-life of vacuum packed (bulk portions) edible byproducts at 2 °C and one regarding shelf-life of consumer packed (smaller portions) edible byproducts at 2 °C and 5 °C respectively. Shelf-life of vacuum packed edible byproducts Edible byproducts (livers, hearts, tongues and tails) were collected at two Danish slaughterhouses. The day after slaughter, the byproducts were vacuum packed, typically one liver, two or four tails, one or two hearts and two tongues in each package and sent to the Danish Meat Research Institute (DMRI) at 2-3 °C. Upon receipt, the temperature was checked and a number of packages were stored at 2-3 °C for as long as four weeks. Triplicate samples from each of the four different edible byproducts were taken on the day they arrived at DMRI and afterwards once a week until four weeks after slaughter. The triplicate samples were analyzed for aerobic, psychrotrophic count (6.5 °C/10 days) and they were subjected to a sensory evaluation (see below). Shelf-life of consumer packed edible byproducts Edible byproducts were collected as vacuum-packed livers, hearts, tongues and tails at two Danish slaughterhouses the day after slaughter. They were sent to the Danish Meat Research Institute at 2-3 °C. Upon arrival, the temperature was checked and afterwards the byproducts were stored at 2 °C for one week. After one week, the packages were opened and the byproducts cut into smaller servings as follows: The hearts and livers were cut into slices and packed in portions of 500 g, the tongues were split in two and packed in portions of half a tongue and finally the tails were split in separate joints and packed in 500 g portions. Each portion was placed in a black plastic

tray and the tray wrapped in permeable film (consumer packaging in ambient air atmosphere). A number of each of the consumer packed edible byproducts were stored at 2 °C and 5 °C, respectively for as long as eight days. Duplicate samples of each of the edible byproducts were taken at day zero (the day they were cut and re-packed) and after two, four and eight days of storage. The duplicate samples were analyzed for aerobic, psychrotrophic count (6.5 °C/10 days) and they were subjected to a sensory evaluation as described below. This study was repeated twice using edible byproducts from the same two slaughterhouses, but from cattle slaughtered during two different weeks (34 and 35; 2009). Microbiological analysis For livers, hearts and tongues, 25 g (mainly the surface part) was removed, 225 ml of FKP (0.85 % NaCl + 0.1 % peptone) was added and the sample was homogenized in a stomacher for 60 sec. From this initial suspension (1:10 dilution), appropriate 10-fold dilutions in 0.85 % NaCl were prepared. For the tails, one joint was removed, the surface roughly estimated as h x w x d (in cm2) and a similar amount of FKP was added and gently massaged by hand. From this initial suspension (undiluted), appropriate 10-fold dilutions in 0.85 % NaCl were prepared. Aerobic, psychrotrophic counts (APC) were determined as described in NKML 86: 2006 [1]. Sensory analysis The sensory quality was evaluated 30 min. after opening the vacuum packs by a non-trained panel of 4-6 employees at DMRI. A value from 1 to 4 (1 = fresh; 2 = slightly diverging but "acceptable"; 3 = diverging to an unacceptable degree, "not acceptable" and 4 = tainted, putrid) was assigned for each of the parameters odour, colour and visual appearance or freshness. From these values an overall evaluation was estimated based on, whether the panellist accepted (value 1) or rejected (value 2) the sample for consumption.

III. RESULTS AND DISCUSSION

Figure 1 presents APC for livers, hearts, tongues and tails collected at two Danish slaughterhouses, vacuum packed and stored at 2°C for four weeks. During the first week of storage, only little bacterial growth was observed, but from week one to week two a significant increase in microbial count was observed. The APC increased further from week two to week three and reached a plateau after approx. three weeks. The corresponding sensory quality is presented in table 1. After as long as two weeks of storage, all the edible byproducts from both slaughterhouses were categorized as sensory acceptable, but after three weeks half of the samples, regardless of type of byproduct, were "not-acceptable". After four weeks storage, only the tongues from one slaughterhouse were acceptable, whereas the remaining byproducts were "not-acceptable". These data confirm that vacuum packed edible byproducts from beef can be given a shelf-life of two weeks from slaughter provided storage at < 3 °C. Figure 2 and 3 present APC for consumer packed edible byproducts (from week 35) stored at 2 °C and 5 °C, respectively for eight days. Prior to storage in consumer packages, the edible byproducts had been stored one week at 2–3 °C in vacuum. It can be seen that the APC increased very rapidly when stored at 5 °C and less rapidly at 2 °C. But even when stored at 2 °C, APC at > 105 cfu/cm2 were reached around day four. Similar results were obtained in the duplicate experiment using edible byproducts slaughtered in week 34 (data not shown). Figure 4 shows the overall sensory evaluation for the consumer packed edible byproducts slaughtered in week 35 and stored at 2 °C and 5 °C respectively. All the byproducts stored at 2 °C were sensory acceptable at day two, but one sample (heart) was "not-acceptable" already at day two, when stored at 5°C. At day four, a few byproducts stored at 2 °C were "not-acceptable", whereas almost all the byproducts were "not-acceptable" when stored at 5 °C. At day eight all the byproducts were sensory "not-acceptable" regardless of storage temperature. These data suggest that consumer packed edible byproducts, previously stored in vacuum for one week at 2-3 °C, shall not be given a shelf-life exceeding two days at 5 °C or three to four days at 2 °C. Preferable they should be consumed within two days in order to ensure the costumer a good sensory quality. In both studies, although no strict correlation between sensory quality and APC could be established, the results indicated that APC above 106 cfu/cm2 increased the risk of the sensory quality for the products being "not-acceptable". This finding emphasizes the importance of good hygiene during slaughter and handling in order to obtain good eating quality for the edible byproducts throughout their shelf-life.

IV. CONCLUSION

The study supports that a shelf-life of two weeks of can be given for vacuum-packed beef edible byproducts if stored below 3°C. For consumer packed edible byproducts, produced from vacuum packed byproducts previously stored one week at 2 °C, the shelf-life

should not exceed three to four days if stored at 2 °C and two days if stored at 5 °C. Although no strict correlation between sensory quality and APC could be established, the study suggests that APC above 106 cfu/cm2 increase the risk of the beef edible byproducts having a poor sensory quality.

ACKNOWLEDGEMENT

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REFERENCES

[1] Nordic Committee on Food Analysis. (2006). AEROBIC MICROORGANISMS, No 86, 4th ed. 2006. Determination in foods at 30 °C, 20 °C or 6.5 °C.

Table 1: Sensory quality of **vacuum packed** beef edible byproducts during storage at 2 °C for up to four weeks.

Week		Liver		Tongue		Heart		Tail	
		Plant A	Plant B	Plant A	Plant B	Plant A	Plant B	Plant A	Plant B
0	Odour	1	1	1,5	1,5	1	1	1	1
	Colour	1	1	1	1	1	1	1	1
	Appearance	1	1	1	1	1	1	1	1
	Overall	accepted	accepted	accepted	accepted	accepted	accepted	accepted	Accepted
1	Odour	1	1,5	1	2	1,5	2	1	1,5
	Colour	1	1	1	1	1	1	1	1
	Appearance	1	1	1	2	1	1	1	1
	Overall	accepted	accepted	accepted	accepted	accepted	accepted	accepted	Accepted
2	Odour	1,5	2	2	2	2	2	1,5	2
	Colour	1	2	1	2	1	2	1	2
	Appearance	2	2	2	2	2	2	1	2
	Overall	accepted	accepted	accepted	accepted	accepted	accepted	accepted	Accepted
3	Odour	3	2,5	3	2	3	2	2	2,5
	Colour	2	1	1	1	2	1	1	1
	Appearance	2	2	2	2	3	2	2	2,5
	Overall	rejected	accepted	rejected	accepted	rejected	accepted	accepted	Rejected
4	Odour	3	4	2	3	3	3	3	3
	Colour	3	2	1	2	2	2	1,5	1
	Appearance	3	2	2	3	3	2	2	2
	Overall	rejected	rejected	accepted	rejected	rejected	rejected	rejected	Rejected

Figure 1: Aerobic, psychrotrophic count for **vacuum packed** beef edible byproducts stored at 2 °C for four weeks; (♦) liver, (■) tongue, (▲) heart and (●) tail.

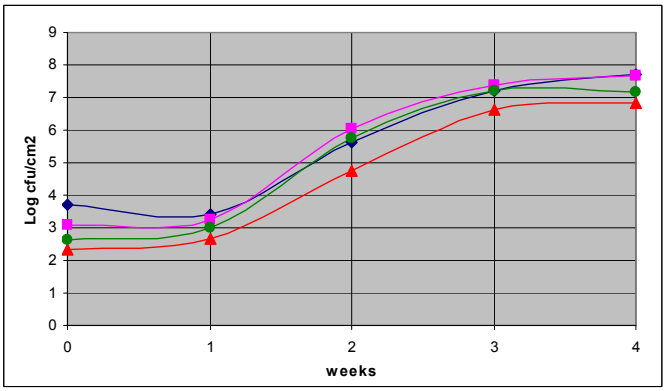

Figure 2: Aerobic psychrotrophic count (log cfu/cm^2) for **consumer packed** beef edible byproducts stored at 2 °C for 8 days. Before re-packing in consumer packaging, the byproducts have been stored vacuum packed for one week at 2-3 °C.

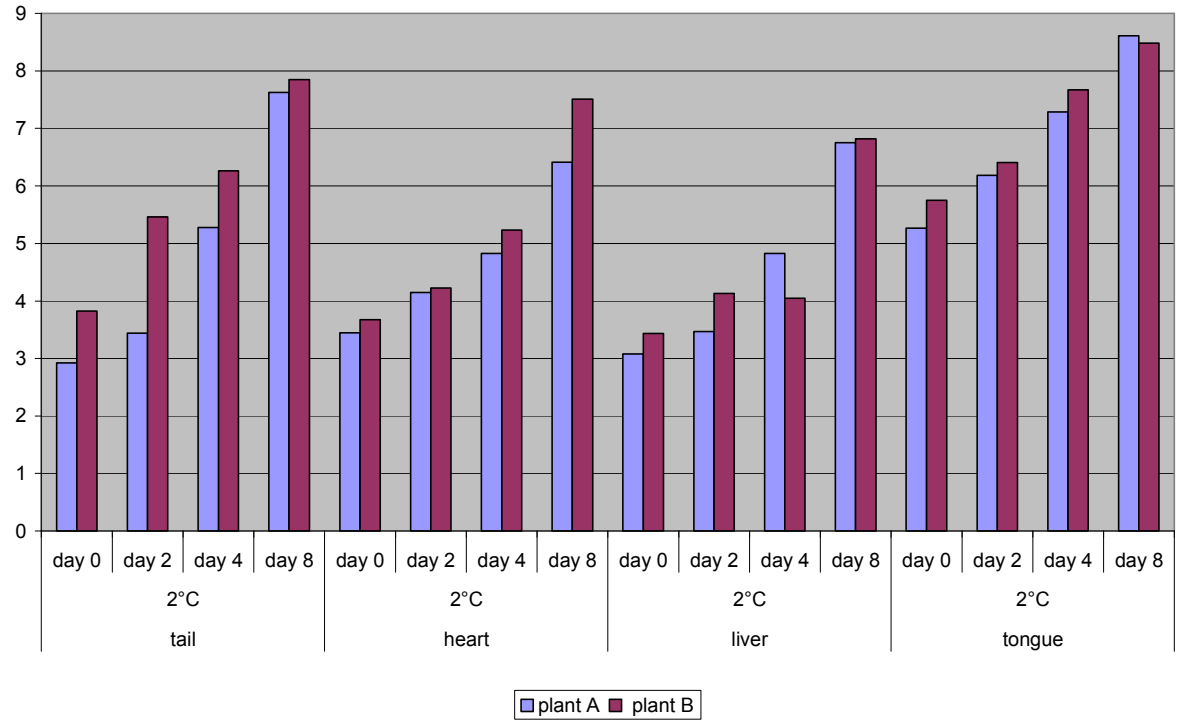

Figure 3: Aerobic psychrotrophic count (log cfu/cm^2) for **consumer packed** beef edible byproducts stored at 5 °C for 8 days. Before re-packing in consumer packaging, the byproducts have been stored vacuum packed for one week at 2-3 °C.

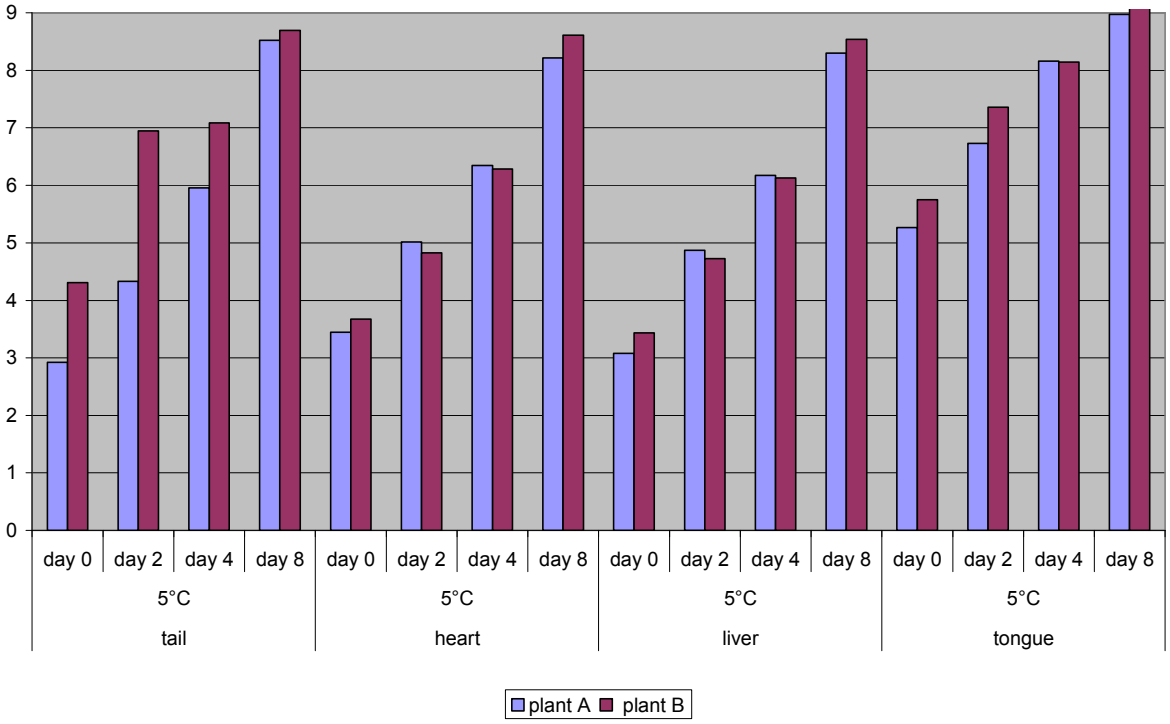

Figure 4: The overall sensory evaluation (1 = accept; 2 = reject) for **consumer packed** beef edible byproducts stored at 2 °C respectively 5 °C for 8 days. Before re-packing in consumer packaging, the byproducts have been stored vacuum packed for one week at 2-3 °C.