COLOUR OF BEEF FROM DIFFERENT CATTLE BREEDS, STORED UNDER VACUUM AND MODIFIED ATMOSPHERE

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BACKGROUND

Meat quality is determined by productive and technological factors. Among productive parameters breed has a direct influence on the composition and, thus, on the quality of meat. One of the most relevant technological factors is packaging, specially these last years, when quality integral systems lead to the packaging of meat at the abattoirs, delivering packaged and labelled meat into the market. So, previous research must be carried out on the effect of this new technology on meat quality, taking animal breed as one mof the factors that are responsable for meat quality.

Among meat quality parameters, is colour is of great importance because, when purchasing fresh meat, consumers judge the acceptability of the product largely on the appearance of the exposed muscle tissue (Allen, 1989). Besides, colour can be adversely affected at all steps of the production, processing and marketing chain, including animal breed, ageing time and temperature; packaging and distribution (Kropf, 1993). Thus, vacuum and modified atmosphere packaging, with one or more gases, can be used to design different atmospheric conditions to maximise the shelf life of meat and to promote desired product characteristics (Hotchkiss and Galloway, 1989).

OBJECTIVE

As colour is one of the most important quality factors of beef, and due to the few reports about the effect of breed on the colour of packaged beef, the objective of the present work was to study the colour of beef from different cattle breeds submitted to three packaging treatments during ageing.

MATERIAL AND METHODS

In the present work, 30 young bulls from 5 different Spanish native cattle breeds (6 animals/breed) were used: Morucha, Asturiana de los Valles, Parda Alpina, Pirenaica and Rubia Gallega. They were managed on identical farming conditions and they were slaughtered at approximately 470 kg life weight. Reference measures were recorded at day 0.

Experimental steaks, from *Longissimus dorsi* muscle, were randomly assigned to three packaging treatments: a) VP: vacuum packaging (15 days); b) MAP: 60% O_2, 30% CO_2, 10% N_2 (15 days), and c) 10 days under VP plus 5 days under MAP. After packaging, and until analyse, all samples were kept at 2 ± 1°C in the dark and 90-95% relative humidity.

CIE L*a*b* (1976) colour physical parameters were measured directly on the meat surface using a MINOLTA CM2002 spectrophotometer with a D65 illuminant and a 10° standard observer. Vacuum packaged samples were allowed to bloom for 1 h, whereas samples under modified atmosphere were analysed immediately after opening the pouches.

A quantitative descriptive analysis (QDA) (Stone, 1974) was used to assess beef colour acceptability.

Statistical analysis was carried out with the SPSS 6.1.2 (1995). The analysis of variance and the Tuckey test were applied to the data.

RESULTS AND DISCUSSION

Figure 1 shows initial beef colour differences among cattle breeds. Morucha and Parda Alpina beef had lower lightness ($p<0.05$) than Asturiana de los Valles, Pirenaica and Rubia Gallega, and Morucha meat was much redder than meat from other breeds ($p<0.05$). There were also slight differences ($p<0.05$) in b* among breeds. Concerning the effect of breed on meat colour, Pertersen et al. (1996) indicated that pigs with a low feed conversion ratio may produce meat with higher lightness. However, these authors stated that the effect of other factors influencing meat colour should be analysed before drawing any final conclusions. In studies carried out by Alberti (1997) with the same animals used in the present work, Morucha cattle showed higher conversion ratio than young bulls from the other studied breeds and they also showed the lower lightness values. So, these colour differences might be attributed to meat composition (Demos and Mandigo, 1996), and thus to breed.

The effect of packaging on colour physical parameters was different during ageing. Beef under vacuum (Figure 3) showed higher redness and lower lightness than beef under MAP (Figure 2), possibly due to the low percentage of oxygen to be kept at superficial layers (Boakye and Mittal, 1996). Beef under VP+MAP (Figure 4) showed similar a* values to meat under vacuum and intermediate lightness between MAP and VP. These results are in agreement with those from Sorheim *et al.* (1996). At day 15, there were no significant differences ($p>0.05$) in b* irrespective of breed and packaging.

Initial differences in lightness remained after 15 days of storage irrespective of packaging. On the contrary, there were no differences ($p>0.05$) in redness (a*) in beef under MAP, but in beef under VP and VP+MAP Morucha meat remained redder than meat from other breeds (Figures 2, 3, 4).

Finally, sensory evaluation of colour evidenced no differences ($p>0.05$) among cattle breeds in beef stored 15 days under MAP. They all showed scores higher than the acceptability limit (75 mm) (Figure 5), possibly due to high metmyoglobin percentages (Gill and Jones, 1994), that are positively correlated to low acceptability in beef under vacuum (Brewer and Wu, 1993). On the contrary, beef samples under VP and VP+MAP were assessed as acceptable by the panellists and there existed breed effect, showing Rubia Gallega meat the best scores.

CONCLUSIONS

Initial beef colour differences among breeds were observed in the present study. MAP might make these differences smaller, but VP and VP+MAP would keep them for L* and a*. However, and as far as the shelf life of beef colour is concerned, packaging effect was more important than breed effect. So, it would be interesting to establish a qualitative understanding of the effects of the packaging atmosphere composition on the colour of each commercial beef type if atmosphere packaging technology and equipment are to be applied more widely and with greater economic efficiency.

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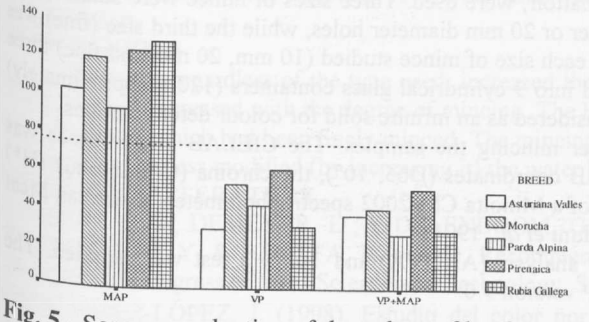

Fig. 5.- Sensory evaluation of the colour of beef stored under MAP, VP and VP+MAP (150 mm: max. discoloration; 75 mm: acceptability limit)

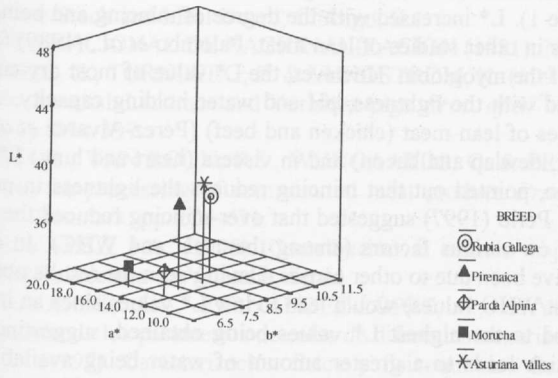

Fig. 1.- Effect of cattle breed on initial beef colour differences (day 0)

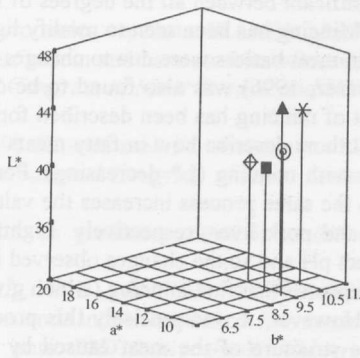

Fig. 2.- Colour of beef stored 15 days under MAP (60% O_2, 30% CO_2, 10% N_2)