FACTORS AFFECTING THE COLOR AND SHELF-LIFE OF RETAIL BEEF STEAKS

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INTRODUCTION

Two problems cited by supermarket meat managers, which cause beef retail meat packages to be discounted or discarded, are poor workmanship and discoloration. Poor workmanship which displays too much fat or bone and therefore lowers the perceived value of the retail beef cut can be remedied through better procurement specifications, management and training. However, discoloration of fresh beef can be a much more complex problem also leading to lower sales and therefore negatively affects profitability. Any improvement in sanitation and temperature control usually lowers bacterial count and lengthens retail shelf life. If the retail packaged beef maintains a desirable bright red color for a longer period, more inventory can be displayed which leads to increased sales. The objective of this study was to compare the impact of 2 retail display temperatures and 3 processing procedures on discoloration and shelf life of retail beefsteaks.

MATERIALS AND METHODS

Sampling

Vacuum packed (boxed) loin strips were purchased at Scolari’s Food and Drug of Sparks, Nevada which included 12 Packer A Choice, 12 Packer A Select, and 12 Packer B strips. One thick (5 cm) knife cut, four regular (2.5 cm) knife cut, and four regular (2.5 cm) saw cut steaks were cut from each vacuum packaged loin strip at one of 11 Scolari’s supermarkets, on a random basis, in Reno and Sparks, Nevada. Steaks were at the anterior end of the loin (13th rib section). Degrees of marbling ranged from slight to moderate when compared to USDA color marbling standards.

Each thick (5 cm) loin steak was bisected into 2 thinner steaks using a sterilized butcher knife at the University Meat Lab. The bacterial samples were taken from the “store” bottom and the “fresh” cut (sterilized knife) surfaces by sponging for total plate count. The resulting steaks were repackaged supermarket style in Styrofoam trays with oxygen permeable film overwrap. The two steaks were packaged such that the original displayed “store” surface was visible in one steak and the “fresh” cut surface in the second steak. The 4 store-knife-cut and 4 saw-cut loin steaks were displayed in the original supermarket trays.

From each loin strip, one fresh-cut, one store-face, two store-knife-cut, and two saw-cut steaks were displayed under 33.9 ± 0.5°F and two store-knife cut and two saw-cut steaks were displayed under 40.6 ± 0.5°F. The bacterial samples were taken from the fresh-cut, store-face, and one of store-knife-cut and saw-cut steaks on the "pull" day. For the other store-knife-cut and saw-cut, the bacterial samples were taken on the "discard" day. Steaks were pulled when meat department personnel would notice any discoloration or darkening. Steaks were discarded when meat department personnel would consider the steak no longer salable due to discoloration.

Bacteria Count

The sponge bags, 25ml of sterile Butterfield's Phosphate Buffer (BP), gloves, and templates were purchased from Biotech Co. for sampling. The sponges were hydrated by adding 25ml of BP buffer and well massaged. The bacterial samples were taken by sponging the steak surfaces followed by bumping each sponge in the sample bag at 8 bumps per second by using the stomacher.
The sample was diluted to the necessary rates.

The total aerobic petrifilm plates were purchased from 3M for microbial growth. 1ml of the diluted sample was inoculated to the petrifilm plate and incubated at 35 ± 1°C for 48 ± 3 hours. The numbers of bacteria were calculated as cells per square of steak surface (cells/cm²).

### Results and Discussion

**Figure 1**

![Graph](image1.png)

Fig. 1-There were significant differences in the discard day between fresh-cut, store face and saw-cut loin steaks (p<0.05).

**Figure 2**

![Graph](image2.png)

Fig. 2-Lower temperature extended the storage days (p<0.05).

**Figure 3**

![Graph](image3.png)

Fig. 3-Steaks cut by store knife discolored less than by saw (p<0.05).

**Figure 4**

![Graph](image4.png)

Fig. 4-There were no differences (p>0.05) in storage days between Packer A Choice, Select and Packer B loin steaks.

**Figure 5**

![Graph](image5.png)

Fig. 5-There was a significant difference in the bacteria count between fresh cut and packer cut (p<0.05) on Day 0 steaks.

**Figure 6**

![Graph](image6.png)

Fig. 6-No significant difference (p>0.05) showed on the discard day.

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### Statistical Analyses

Results were analyzed by analysis of variance using the GLM procedure of SAS (1985). For variables that were measured over time, a repeated measure analysis was performed (Freund et al., 1986). MXANOVA, SAS macro was used for analyzing mixed factor ANOVA and checking for the violations of assumptions (Fernandez, G.C.J. 1997).
Fig. 7-No significant difference (p>0.05).

Fig. 8-Bacteria counts of Packer A Select loin steaks were lower than Packer A Choice and Packer B (p<0.05). No difference was detected between Packer A Choice and Packer B (p>0.05).

Fig. 9-No significant difference (p>0.05).

Using a sterilized knife to cut a steak extended the storage days (p<0.05, Fig. 1 and 3). It also decreased the bacteria numbers of the steak surfaces on Day 0 (p<0.05, Fig. 5), but there were no significant differences of the bacteria count on the discard day (p>0.05, Fig. 6 and 7). Fresh-cut steaks in the retail display case maintained desirable color longer than store-face steaks followed by saw-cut steaks.

Lower temperature helped steaks staying longer as well (p<0.05, Fig. 2). Obviously, lower temperature decreased bacteria growth but the difference was not significant (p>0.05, Fig. 9).

The loin steaks purchased from different packers and grades, Packer A Choice, Packer A Select, and Packer B, showed no differences on the storage days (p>0.05, Fig. 4), but Packer A Select beef has lower bacteria counts than other two brands (p<0.05, Fig. 8). Packer A choice loins were dry aged which could account for the higher bacterial count. These are the "good" bacteria that develop during aging.

This study demonstrates the importance of sanitation and temperature control on retail beefsteak discoloration. The supermarket meat department can increase beef sales and profits by following recommended sanitation procedures and maintaining strict temperature controls.

**LITERATURE CITED**


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