EFFECT OF TYPE AND SEX ON BEEF QUALITY OF COMMERCIAL CATTLE IN THE TROPICS

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Puerto Rico is lacking a classification system for locally produced beef. This could result in consumer preference for US imported beef, which has quality classification labels. Eighty-one carcasses were selected randomly from two commercial slaughterhouses. Subsequently, *Longissimus dorsi* (LD) was taken and analyzed [pH, color (L*, a*, b*) and Warner-Braztler Shear force (WBSF)] 24 hours *post-mortem*. A sample classification according to type of cattle (dairy vs. beef), sex and age was used. A tendency toward significance was observed in WBSF (p-value=0.06) for the effect of type. In that regard, the beef type cattle presented lower WBSF values. Also, a lower pH resulted in the beef type cattle (p-value = 0.05). There was a significant interaction between sex and type of cattle for colors a* (redness/greenness) and b* (yellowness/blueness). There were differences between sex for color a* in beef and dairy type cattle (p-value=0.03). Differences in color a* and b* were obtained between gender groups with males in beef and dairy type cattle having greater values (p-value=0.009 and p-value=0.01, respectively). All meat samples evaluated in the present study showed normal pH values, and color was within a range that could be appealing to the consumers.

I. INTRODUCTION

In Puerto Rico there is no classification system for locally produced beef. This causes that all cattle that is sacrificed in the island ends up in the fresh meat aisle regardless of quality parameters. Tenderness and color of beef are very important traits used to determine meat quality. Consumer's rate meat with 5.7 kg or less of Warner-Braztler Shear Force (WBSF) as acceptable meat (1) and US beef consumers are willing to pay a premium of $4.05/kg for guaranteed tender meat (2). Beef color intensity and brightness is very influential when the consumer has to choose. Bright red color is the one preferred by the consumer; for it indicates freshness and that the beef came from young animal. Much research has been directed to these attributes with the expectation of better understanding the mechanisms responsible for acceptable color, greater tenderness and sensory palatability (3, 4, 5, 6). All these factors including the low economic value obtained per pound produced have greatly affected our local production of beef. In the last four years, a 15% decrease in production, equivalent to 5 million pounds of meat produced in the Island, was reported by the USDA Agriculture Statistics of Puerto Rico (7). Also, it seems that Puerto Rican beef consumers are un-impressed by local non-classified beef when compare to the increasing variety of imported meat with quality labels.

The objective of this study was to evaluate the effect of type of cattle and sex on pH, color and tenderness of beef from commercial cattle raised in the tropic. This study is part of a major project aimed to determine the reliability of a potential classification system based on chronological age and sex of slaughtered cattle, and to provide specific recommendations to ensure the production of tender beef in the Island, focusing on the effects of aging as a fundamental tool for sensory improvement of beef. The advantage of having a meat classification system based on scientific evidence could greatly improve the beef cattle industry, especially in tropical environments.

II. MATERIALS AND METHODS

Eighty-one carcasses were selected randomly at two commercial slaughterhouse located at the south (Ganadería Santiago) and north (Ganaderos Alvarados) regions of Puerto Rico. These were classified by type of cattle (dairy vs. beef), sex (female vs. male) and age. The latter were determined by the number of permanent incisors (0, 2, 4, 6, 8) as described by Casas *et al* (8). All harvesting and processing was in compliance with the HACCP model for beef slaughter of the

USDA Food Safety and Inspection Service.

The *Longissimus dorsi* LD samples of each carcass were taken of the left hindquarter and were analyzed 24 hours after slaughter for pH (Meter Model No. 1142003 SP70P, VWR International, Batavia, IL), instrumental color measurements [L* (lightness; 0: black, 100: white), a* (redness/greenness; positive values: red, negative values: green), and b* (yellowness/blueness; positive values: yellow, negative values: blue)] using a photometer Mini Scan EZ 45/0 LAV (Hunter Lab, Reston, VA). Tenderness was determined by Warner-Bratzler shear force according to the AMSA (1995)'s guidelines.

The experimental design was completely randomized and the data was analyzed using PROC GLM of SAS (version 9.2). The lineal model included the fixed effects of type, sex and its correspondent interaction. In addition, the number of permanent incisors was used as a covariate. Means were separated by LSD test. The level of significance considered in this study was 0.05.

III. RESULTS AND DISCUSSION

In the present study a lower pH was observed in the beef type cattle at 24 hrs *postmortem* (Fig. 1).

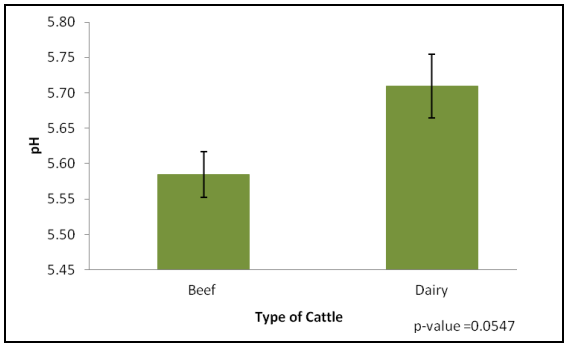

Fig. 1 Differences in pH between beef and dairy type cattle at 24 hrs *postmortem*

In addition, there was a significant interaction between type of cattle and sex for both color a* and b* (Fig. 2 and 3, respectively). The beef type cattle color a* was higher in males than females (15.731±0.496, 14.223±0.464; respectively, p-value=0.03). Meanwhile, the dairy type cattle did not show sex differences (13.714±0.587 males vs. 14.678±0.464 females, p- values>0.05). Similarly, in females, beef and dairy type cattle did not have differences (p-value> 0.05). However, the color a* in males was different by type of cattle (15.731±0.496 beef and 13.714±0.587 dairy, respectively, p- value=0.009).

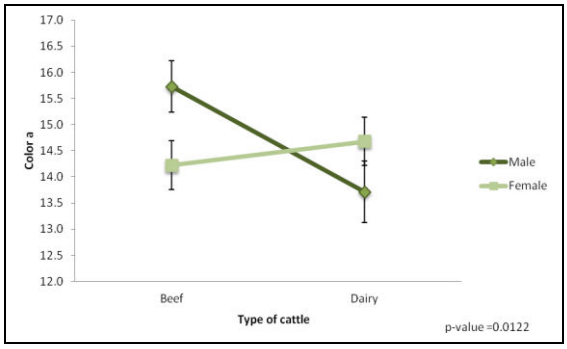

Fig. 2. Sex by type of cattle interaction for color a* at 24 hrs *postmortem*

The color b* value in dairy type cattle was not affected by sex as well as the beef type cattle (p-value>0.05). In the contrary, it was different between males in the beef and dairy type cattle (11.720±0.476, 9.930±0.564; respectively, p-value=0.01). There was no difference in color L* for the meat samples (p-value>0.05).

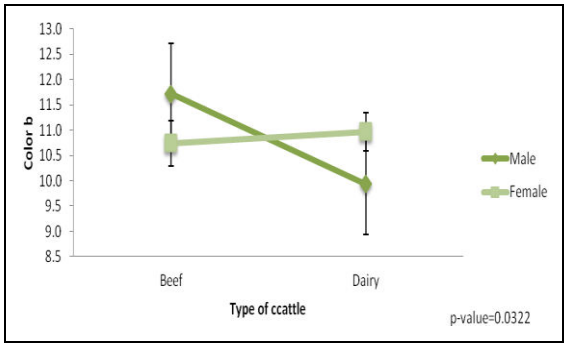

Fig. 3 Sex by type interaction for color b* at 24 hrs *postmortem* (P = 0.01).

The pH range for bovine LD muscle with normal postmortem metabolism is 5.40 to 5.59 (9). According to USDA grading standards, meat with a pH value of 5.87 or greater is classified as “dark cutters” (9). A high pH and dark meat color is characteristic of cattle that suffered from stress before slaughter (3, 10). Even though in the present study dairy type cattle presented a higher pH (5.71) than beef type cattle (5.58), it could not be classified as dark cutter. However, there is an indication that beef type cattle could result in a better quality and shelf life due to a more compromised muscle metabolism in dairy type

cattle. This in turn could affect the postmortem conversion of muscle to meat. The WBSF of our study presented a tendency towards significance for the effect of the type of cattle (p-value = 0.06). The beef type cattle had lower WBSF than the dairy type cattle. The average WBSF of the analyzed LD samples from cattle sacrificed in Puerto Rico is 6.9 kg (6.92 ± 0.42) for beef type cattle and 8.6 kg (8.64 ± 0.54) for dairy type cattle, resulting in a combined WBSF value of 7.75 kg. Such values are not in range for the locally produced beef to be considered tender, given that a tender beef classification should be associated with a WBS of 5.7 kg or less (1).

Meat color is of great importance since it's the first thing consumers see when they purchase meat (3, 9). The consumer discriminates against darker colored meat because of its association with decreased freshness (3). Meat with a high ultimate pH will present a dark purple color. This occurs because there is less space between muscle fibers due to the high water holding capability of this meat and not much light is reflected (9, 10, 11). Even though no differences were observed in L* value in this project, the meat from LD beef males were redder and yellower, which could result in a more visually appealing color combine product.

IV. CONCLUSION

In this study, commercially produced meat from beef type cattle presented a tendency to have a lower WBSF. Also, this type of animal showed a lower, more favorable pH, and in males a different and potentially more appealing color was observed. These findings are the first steps towards the establishment of an appropriate classification system for the beef produced in Puerto Rico.

ACKNOWLEDGEMENTS

This study was part of the project entitled: *Assessment of Minimal Postmortem Maturation for Acceptable Beef Tenderness Profiling (ZFIDA-17)* funded by the Department of Agriculture of Puerto Rico. We want to thank Ganadería Santiago and Ganaderos Alvarado for their collaboration on the sample collection.

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