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MATERNAL BOVINE APPEASING SUBSTANCE (mBAS) AS A TOOL TO IMPROVE BEEF QUALITY: PRELIMINARY RESULTS ON CARCASS pH

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I. INTRODUCTION

Pre-slaughter stress is a critical factor influencing meat quality, with direct impacts on ultimate pH. In Brazil, the world's largest beef exporter [1], this issue is particularly relevant due to the country's vast territorial size and predominantly extensive production systems. Elevated pH values in beef are associated with darker meat color, reduced shelf life, and lower consumer acceptance. To mitigate the adverse effects of pre-slaughter stress, the use of maternal appeasing substance (mBAS) has been proposed as a practical strategy to promote calmer behavior in livestock [2]. FerAppease® (Ourofino Animal Health), an analogue of the mBAS, has been developed to mimic natural chemical signals that induce calming effects, potentially improving carcass characteristics. This study aimed to evaluate the effect of a synthetic mBAS on beef carcass pH, hypothesizing that its application at the farm during animal loading for transport to the slaughterhouse would reduce the incidence of high pH values by minimizing stress responses. The research aligns with ongoing efforts in the Brazilian beef industry to enhance animal welfare and improve compliance with international sanitary standards through non-invasive, field-applicable interventions.

II. MATERIALS AND METHODS

This study included a total of 1,200 Nelore bulls, comprising both grass and grain-fed (feedlot-finished) animals. Of these, 600 grass-fed animals were sourced from a farm located in the municipality of Várzea da Palma (17°35′44″S, 44°43′15″W), in the northern region of Minas Gerais, Brazil. The remaining 600 bulls were feedlot-finished and originated from a commercial facility in Frutal (20°01′32″S, 48°56′00″W), located in the western region of Minas Gerais. Both regions are characterized by a tropical climate.

In each production system, animals were randomly allocated to two experimental groups: Control (n = 300), which received no intervention, and Treated (n = 300), which were administered a synthetic mBAS (FerAppease® - Ourofino Animal Health, Cravinhos, Brazil), following the manufacturer's recommendations. The treatment was applied topically using a pour-on method, with 5 mL of mBAS applied to the nape and 5 mL to the rump during individual weighing, immediately prior to transport.

Grass-fed cattle were transported over a distance of 870 km, with an average journey time of 20 hours. Grain-fed cattle traveled 150 km, with an average journey time of 2 hours. Standardized transport conditions were maintained across all groups, including similar stocking densities and transport procedures appropriate for each route. Upon arrival at the processing facility, animals from each group were kept in separate holding pens to avoid potential residual contact with the product. All animals were subjected to lairage for a minimum of 12 hours with free access to water. Pre-slaughter and slaughter were performed in accordance with humane handling protocols, as required by Brazilian legislation and international animal welfare standards.

Carcass pH was measured 24 hours post-slaughter at the Longissimus thoracis muscle, between the 11th and 12th ribs, using a calibrated portable pH meter with a penetration electrode (Hanna Instruments®). For statistical purposes, pH values were converted into a binary scale: values above 5.90 were classified as 1 (high pH), and values up to 5.90 were classified as 0 (normal pH). The threshold of 5.90 was established based on commercial agreements with specific international markets, which require beef to exhibit a final pH below this value as a condition for export eligibility.

For the pH variable in the original scale, both for pasture and feedlot animals, a General Linear Mixed Model was used, considering the fixed effect of treatment (control versus animals treated with mBAS), as well as the random

effects of age-fat class and error. To evaluate pH as binary variable (0 = pH up to 5.90; and, 1 = pH above 5.9), a Generalized Linear Mixed Model was adopted, considering the binary distribution and using the logit link function. In these analyses the same model described previously was used. In case of significant results in the type 3 variance analyses, the F test is currently used as discriminatory. All analyses were performed using the PROC MIXED and PROC GLIMMIX procedures, respectively, of the Statistical Analysis System program, version 9.4 (SAS Institute Inc., Cary, NC, USA).

III. RESULTS AND DISCUSSION

For the grass-fed group, the average carcass weight was 281.71 kg, standard error (SD) = 12.29, with a coefficient of variation (CV) of 8.73%, and a range from 229.00 to 367.00 kg. The mean final carcass pH was 5.80 (SD = 0.34), with a CV of 5.84%, ranging from 5.41 to 6.72. The binary pH classification (PH_BIN), which categorizes carcasses based on a 5.90 pH threshold, showed a mean of 0.31 (SD = 0.46) and a high CV of 149.33%. For the grain-fed group, the average carcass weight was slightly higher at 290.19 kg (SD = 15.94), with a CV of 10.98%, and weights ranging from 218.00 to 431.00 kg. The mean pH was lower compared to grass-fed animals, averaging 5.67 (SD = 0.14) with a CV of 2.55%, and ranging from 5.43 to 6.36. The mean PH_BIN was 0.05 (SD = 0.21), with a very high CV of 452.96%, indicating a low overall occurrence of high pH carcasses in this production system.
In grain-fed animals, the proportion of carcasses with a final pH >5.90 was 6.09% in the Control group (N = 289) and 2.99% in the mBAS-treated group (N = 291), showing a trend toward significance (P = 0.0765), corresponding to a 50.8% reduction in the incidence of high pH carcasses. In grass-fed animals, the percentage of carcasses exceeding the pH threshold was considerably higher, with 44.76% in the Control group (N = 148) and 29.34% in the mBAS group (N = 148), demonstrating a significant difference between treatments (P = 0.0150) and representing a 34.6% reduction (Figure 1A).
Regarding the mean pH values, in grass-fed cattle, the mBAS group exhibited a lower average pH (5.79) compared to the Control group (5.87), with a statistically significant difference (P = 0.0463). In grain-fed animals, the Control group had a mean pH of 5.68, while the mBAS group had a mean pH of 5.66, also showing a significant difference (P = 0.0479) (Figure 1B).

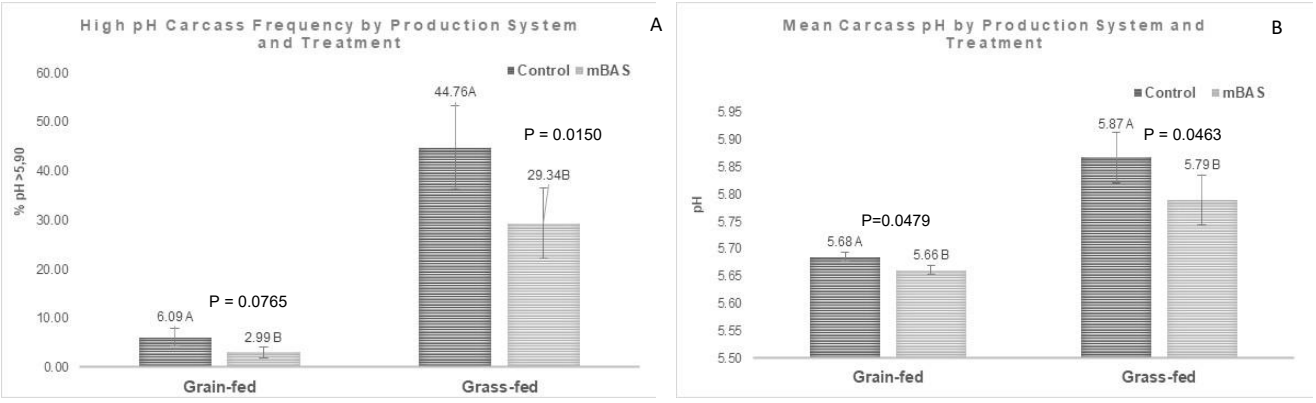


Figure 1. Impact of maternal bovine appeasing substance (mBAS) treatment on carcass pH parameters: (A) frequency of carcasses with final pH >5.90 and (B) mean final carcass pH in grain-fed and grass-fed production systems.

IV. CONCLUSION

These preliminary results indicate that the use of the maternal bovine appeasing substance (mBAS) may contribute to mitigating the incidence of high final pH carcasses and reducing mean pH values, particularly among grass-fed animals. The study will be continued with a larger number of animals to corroborate these results and enhance their statistical reliability.

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