# COMPARISON OF DENTAL CARCASS MATURITY IN NELLORE BULLS: EFFECTS ON CARCASS AND MEAT QUALITY TRAITS

Yasmin V.F. Madio<sup>1</sup>, Ana Paula Moraes<sup>2</sup>, Evelyn R. dos Santos<sup>2</sup>, Leonardo H. F. Munhoz<sup>2</sup>, Guilherme L. Pereira<sup>3</sup>, Rogério A. Curi<sup>3</sup>, Luis Artur L. Chardulo<sup>3\*</sup>, Otavio R. Machado Neto<sup>3</sup>, Welder A. Baldassini<sup>3\*</sup>

<sup>1</sup> São Paulo State University (UNESP), School of Agricultural and Veterinary Sciences, Jaboticabal, Brazil

<sup>2</sup> JBS Friboi, São Paulo, Brasil.

<sup>3</sup> São Paulo State University (UNESP), School of Veterinary Medicine and Animal Science, Botucatu, Brazil

\*Corresponding author's email: <u>luis.artur@unesp.br</u>; <u>w.baldassini@unesp.br</u>

## I. INTRODUCTION

Brazilian slaughterhouses use the number of permanent incisor (PI) teeth to classify beef carcasses, which indicates the age at slaughter [1]. However, the number of PI teeth does not directly reflect the physiological maturity, with little association with meat quality traits such as intramuscular fat, color, and tenderness [2]. Therefore, United States and Australia use the ossification score (OS) to indicate physiological maturity and its impacts on beef quality [3,4]. Thus, the objective was to evaluate how age (measured by PI teeth) impact the carcass and meat quality traits of Nelore bulls and its association with OS.

## II. MATERIALS AND METHODS

Nellore bulls (Bos indicus) with average final body weight of  $550 \pm 11$  kg were used. At slaughter, following head inspection, the number of PI was recorded for each animal. Subsequently, carcasses were randomly selected per dentition group, totaling 90 carcasses grouped in two categories (6 PI [n=45] and 8 PI [n=45]). After 24h chilling (2 to 4 °C), all carcasses were evaluated for OS, following the Australian model [5]. Additionally, hot carcass weight (HCW), ribeye area (REA), backfat thickness (BFT), and marbling score (MAR) were assessed. At deboning, Longissimus thoracis samples between the 11<sup>th</sup> and 13<sup>th</sup> ribs of the left half-carcass were collected. Two samples (2.54 cm thickness) from each experimental group were vacuumpacked and wet-aged for 21 and 28 days (1 to 2 °C) and then frozen (-20 °C). Initially, the samples were thawed (1 to 2 °C for 24h) and exposed to oxygen for 30 minutes at 2 °C (blooming). The meat pH, waterholding capacity (WHC), and color parameters (L\*, a\*, b\*, Chroma, and Hue) were measured according to described procedures [6,7]. Finally, Warner-Bratzler shear force (WBSF) and cooking losses - CL (divided in evaporation [EL] and drip [DL]) were obtained [8,9]. Data of carcass (HCW, BFT, REA, OS, and MAR) and meat quality traits (pH, WHC, L\*, a\*, b\*, Chroma, Hue, WBSF, CL, EL, and DL) were compared using analysis of variance (ANOVA). The animal (carcass) was considered the experimental unit, and PI number (treatment) was used as a fixed effect in the statistical model. Differences were considered significant when P < 0.05. The relationships between variables were also studied through principal component analysis (PCA) and partial least squares-discriminant analysis (PLS-DA) using R software (v.4.1.2).

## III. RESULTS AND DISCUSSION

Greater OS and REA (P<0.05) were observed in animals with 8 compared to 6 PI (Figure 1), while HCW, BFT and MAR were similar. Moreover, PI teeth impaired (P<0.05) meat color at 28 days of aging, reducing  $b^*$  and Hue (Table 1). Additionally, DL was lower (P<0.05) in 8 PI group, whereas other meat quality traits were similar. Both variables OS and DL affects data variability at 21 days (Figure 2A), whereas OS, WHC,  $b^*$ , and Hue were the most important variables at 28 days of aging (Figure 2B). Relationships between OS and WHC, as well as between pH and color parameters ( $b^*$  and Hue), help explain the separation of PI groups projected in the multivariate space (27% of accumulated variance) showing why these animals had differences in meat quality. Particularly, animals with 8 versus 6 PI were divergent for OS, WHC,  $b^*$  and Hue, suggesting differences in musculosity, chemical composition or lipid content, as observed [10]. However, additional biochemical assays are necessary to confirm this hypothesis.





Table 1. Meat quality traits of Nellore bulls with 6 versus 8 permanent incisors (PI) teeth.

PI teeth			PI teeth			
Variables <sup>1</sup>	6	8	P-value	6	8	<i>P</i> -value
21 days of aging			28 days of aging			
рН	5.53 ± 0.1	5.51 ± 0.2	0.471	5.27 ± 0.2	5.32 ± 0.1	0.106
L*	38.02 ± 2.2	37.53 ± 3.6	0.394	40.78 ± 3.5	41.83 ± 3.5	0.161
a*	17.64 ± 2.0	17.71 ± 2.4	0.888	18.25 ± 2.6	18.23 ± 1.7	0.770
b*	7.85 ± 1.4	8.03 ± 1.6	0.579	9.10 ± 1.5	8.42 ± 1.6	0.049
Chroma	19.34 ± 2.2	19.49 ± 2.6	0.773	20.44 ± 2.7	20.11 ± 2.1	0.532
Hue	23.97 ± 3.5	24.35 ± 4.3	0.711	26.59 ± 3.8	24.58 ± 3.3	0.010
WBSF	3.66 ± 0.7	3.66 ± 0.8	0.768	3.46 ± 0.7	$3.45 \pm 0.6$	0.879
CL	31.47 ± 5.0	31.00 ± 4.8	0.642	33.34 ± 5.0	34.61 ± 11.0	0.850
EL	$28.20 \pm 6.0$	27.86 ± 5.7	0.786	29.19 ± 5.8	31.89 ± 11.7	0.189
DL	3.26 ± 2.3	3.13 ± 2.6	0.805	4.15 ± 2.7	2.71 ± 1.8	0.004
WHC	61.28 ± 2.5	61.13 ± 2.3	0.775	59.52 ± 3.0	58.24 ± 3.7	0.082

<sup>1</sup>pH = meat pH, *L*\*: lightness, *a*\*: redness, *b*\*: yellowness, WBSF: Warner-Bratzler shear force, CL: cooking losses, EL: evaporation loss, DL: drip loss, WHC: Water-holding capacity.



Figure 2. Principal component analysis and partial least squares-discriminant analysis of carcass and meat quality traits of Nellore bulls with 6 versus 8 permanent incisors (PI) teeth. Meat aged for 21 (A) and 28 (B) days.

### IV. CONCLUSION

Nellore bulls slaughtered with 6 or 8 PI teeth differ in terms of OS and REA but are similar regarding meat tenderness (WBSF) and pH. However, meat color (yellowness and *Hue*) of 8 PI group was impaired at 28 days of aging, while drip losses decrease compared to 6 PI group.

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