CORRELATION BETWEEN LAB VALUES AND MYOGLOBIN FRACTIONS IN DRY-AGED BEEF

Ana J. Ribeiro[1,2•*], Fernando G. Braga[3•], Paula Teixeira[4] and Cristina M. Saraiva[1,2]

[1] Department of Veterinary Sciences, University of Trás-os-Montes e Alto Douro (UTAD), Vila Real, Portugal

[2] Animal and Veterinary Research Centre (CECAV), University of Trás-os-Montes e Alto (UTAD), Vila Real, Portugal

[3]Chemistry Center, University of Trás-os-Montes e Alto Douro (UTAD), Vila Real, Portugal

[4] Centre for Biotechnology and Fine Chemistry (CBQF) – School of Biotechnology, Catholic University, Porto, Portugal

● These authors contributed similar for this work

*Corresponding author email: anajacinta83@gmail.com; anaribeiro@utad.pt

I. INTRODUCTION

The Lab color space is a color model used in digital imaging, representing colors through lightness (*L**) and chromaticity coordinates *a** (redness) and *b** (yellowness) [1]. Unlike other models, *Lab* is designed to be perceptually uniform, meaning changes in values correspond to changes in perceived color. This ensures color measurements align with human visual perception, crucial for assessing meat quality [2]. *Lab* parameters can detect subtle color changes that often correlate with other quality attributes like freshness, tenderness, and juiciness. For instance, the *L** value indicates meat brightness, while a decrease in *a** might suggest a loss of redness linked to freshness [3]. Thus, *Lab* allows standardized color measurements across different meat batches and types, aiding consistent quality control and ensuring products meet color standards required by consumers and regulatory bodies [2]. However, its use in monitoring meat dry-aging processes is rarer [2, 4].

This work evaluates extending the *Lab* model's usefulness for controlling and characterizing beef dry-aging processes. We analyzed the relationship between the mentioned parameters and amounts of various myoglobin fractions, such as purple-red Deoxymyoglobin (DMb) in unoxygenated meat, bright red Oxymyoglobin (OMb) in oxygenated meat, and brown Metmyoglobin (MMb), indicating oxidized meat [5, 6].

II. MATERIALS AND METHODS

Six loins (*L. lumborum*) with the same characteristics were selected, identified as A, B, C, X, Y, and Z, divided into three pieces, and aged for 60 days in a dry aging room. On days 1, 14, 35, and 60, the color *L***a***b** was measured on lean meat at room temperature using a chroma meter (CR410, Konica Minolta Co., Japan) calibrated with a standard white tile. CIE values were measured at three random locations on each sample.

Myoglobin fractions were quantified spectrophotometrically (GENESYS 50 UV-Vis, ThermoScientific, USA) using the method by Krzywicki [7], modified by Suman & Joseph [8], on 1.5 g of each thawed meat sample. After adding 4.0 mL of pH 6.8 phosphate buffer, samples were homogenized for 5 minutes until uniform and then centrifuged at 5,500 RPM for 15 minutes at 4°C. The absorbance of the clarified supernatants was measured at 525 nm, 545 nm, 565 nm, and 572 nm. Krzywicki's equations were used to determine the relative concentrations of DMb, OMb, and MMb based on their characteristic absorbance peaks.

III. RESULTS AND DISCUSSION

As shown in the first two graphs below (Figure 1A and 1B), which separately represent variations in *L**, *a**, and *b** values, and DMb, OMb, and MMb concentrations for sample C, no directly correlatable trend is evident between the CIE values and the levels of different myoglobin forms. Due to the editorial limit of two pages per communication, only the data for sample C is presented. However, the rightmost

graph (Figure 1C) and Table 1 demonstrate a surprisingly accurate correlation between the values of (*L**/40) and the sum of OMb and MMb concentrations, with 83% of the samples showing errors of 15% or less. Table 1 does not present the individual values of all parameters but only the percentage errors, again due to editorial constraints.

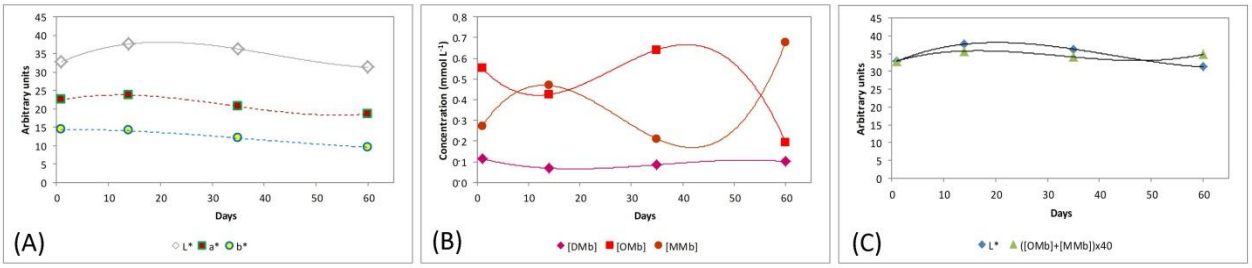

Figure 1. Scatter plots with smooth lines for sample C showing: (A) the variation *L**, *a** and *b** ; (B) [DMb], [OMb] and [MMb]; and (C) the color *L** and the sum of [OMb]+[MMb] with the correction factor of 40, all during the aging days.

Table 1 – Percentage error between measured and predicted Σ[OMb + MMb] based on *L**/40 value

	Aging time (days)			
Samples	1	14	35	60
A	45.26	2.75	-1.13	2.05
B	-4.17	3.71	-9.44	-15.41
C	-17.53	-10.59	-14.80	-12.98
X	-6.03	-19.11	-4.84	-4.66
Y	-10.57	-14.71	4.76	13.78
Z	-9.64	-28.56	-10.94	0.34

IV. CONCLUSION

Despite the relatively low number of samples, the results show a consistent correlation between *L** and the sum of OMb and MMb, representing a small but promising step toward finding and validating new analytical methods for understanding the physical-chemical processes in beef dry aging.

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