EVOLUTION OF COLOR IN REFRIGERATED VACUUM-PACKED BEEF ACROSS A 90-DAY PERIOD

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I. INTRODUCTION

Meat color is a key feature from a commercial standpoint, as most consumers develop a strong preference because of meat color [1]. However, the color perceived by consumers is a subjective appreciation, due to the physical interaction of light with meat, which is registered by the human eye and interpreted by the brain [2]. CIELab is an international standard used for the measurement of color, adopted by the International Commission on Illumination (CIE) in 1976. Currently, it is the most appropriate system to measure the color of food [3]. Meat color has a significant influence on the preference of consumers and in their likelihood to buy beef, as it is the first factor that is perceived by the them [4, 5]. The aim of this work was to measure texture variations in 3 commercial cuts of beef that were vacuum-packed and stored at 4°C across a 90-day period.

II. MATERIALS AND METHODS

Slices were taken from the cuts of beef and analyzed in a Hunter Lab Color QUEST reflection spectrophotometer colorimeter. Illuminant B at a 45° angle was used on a 2.54 cm diameter visor, in order to measure the coordinates, the CIELab color space, where L* measures luminosity, ranging from 0 (black) to 100 (white); a* measures red intensity, ranging from +a (red) to -a (green), and b* measures yellow intensity, ranging from +b (yellow) to -b (blue). 3 measurements were taken for each portion and for each fresh commercial cut of meat in samples A, B and C. Their L*, a* and b* parameters, as well as their reflectance spectrum, ranging from 400 to 700 nm in 10 nm stages, were measured. To evaluate the differences between treatments, we used the Friedman test with a significance level of $p = 0.05$.

III. RESULTS AND DISCUSSION

L* (luminosity), a* (red-green intensity) and b* (yellow-blue intensity) values were measured for sirloin tip. For L*, the cut shows a similar pattern as that of striploin, starting at 32.54 on day 1 and peaking at 38.93 at day 90, showing an undulating distribution across time and a significant statistical difference ($p<0.05$). For a*, the lowest value was seen at day 45 (13.33), and its highest values were found on days 1 (15.33), 5 (15.28), 10 (15.39) and 75 (15.68), without any significant difference across all 90 days ($p=0.26$). For b*, average values were aroun 12, with its lowest value on day 1 (11.85) and its highest value on day 90 (14.16), i.e. no significant statistical difference was found ($p=0.65$). For striploin, it can be seen that the L* value increases progressively across time, reaching a maximum value of 37.88 on day 90. However, at day 60 the value is lower (33.42), which reflects a significant statistical difference ($p=0.04$). While comparing reflectance with eye of round, it is evident that striploin is a darker cut of beef when compared to the former. In eye of round, it can be seen that the average values for L* tend to go from a darker to a lighter shade, i.e., from opaque to brighter tones with values ranging from 38.9 on day 1, with an average of 40.1 starting from day 10, to a peak of 42.9 on day 90. However, no significant statistical difference was found ($p=0.17$). For the a* value (red), it can be seen that on day 1 red color is more intense (16.2) and decreases on day 10 (13.4), to finally remain relatively constant starting from day 25 until day 90, which is evidenced by a statistical difference ($p=0.04$) (Table 1).

Table 1 Average values for L*, a* and b* across a 90-day period in eye of round, striploin and sirloin tip.

	Sirloin tip			Striploin			Eye of round		
Time	L*	a*	b*	L*	a*	b*	L*	a*	b*
1	32.54^{ab}	15.23^{abc}	11.85^{a}	32.50^{abc}	16.20^{c}	13.00^{bc}	38.9^{a}	16.2^{h}	17.6^{def}
5	30.98^{a}	15.28^{abc}	12.09^{a}	33.59^{abcd}	13.26^{ab}	10.86^{a}	39.0^{ab}	14.5^{defgh}	15.7^{abcdef}
10	32.15^{abcde}	15.39^{bc}	13.71^{a}	32.27^{ab}	15.37^{c}	12.79^{bc}	40.1^{abcd}	13.4^{abcdefgh}	15.4^{abcdef}
15	32.45^{abcd}	14.81^{abc}	12.83^{a}	32.01^{a}	14.74^{abc}	11.68^{abc}	40.1^{abc}	12.8^{abcdefg}	15.5^{abcdef}
20	35.18^{abcdef}	14.07^{abc}	12.94^{a}	33.93^{abcdef}	13.80^{abc}	12.28^{abc}	40.4^{abcde}	14.9^{defgh}	16.8^{f}
25	34.50^{abcdef}	13.75^{abc}	11.92^{a}	34.58^{abcdefg}	13.33^{abc}	11.79^{abc}	41.7^{cde}	12.6^{abcdef}	15.4^{abcdef}
30	32.57^{abc}	14.39^{abc}	12.09^{a}	34.36^{abcdefg}	13.79^{a}	12.17^{ab}	40.5^{abcde}	11.7^{abc}	14.4^{abc}
45	36.53^{def}	13.33^{a}	12.30^{a}	35.45^{cdefg}	14.12^{abc}	12.10^{abc}	41.0^{abcde}	12.3^{abcd}	14.7^{abcde}
60	34.50^{abcdef}	13.54^{abc}	12.50^{a}	33.42^{abcde}	14.12^{abc}	12.52^{bc}	41.3^{abcde}	11.7^{ab}	14.9^{ab}
75	33.11^{abcdef}	15.68^{c}	13.45^{a}	35.44^{defg}	14.50^{abc}	13.82^{bc}	40.0^{abcde}	11.9^{a}	14.9^{abcd}
90	38.93^{f}	13.52^{ab}	14.16^{a}	37.88^{g}	15.67^{c}	14.21^{c}	42.9^{e}	12.7^{abcde}	14.9^{a}

Different letters indicate a difference ($p<0.05$) in the column.

IV. CONCLUSION

There is a significant difference ($p<0.05$) in the a* value for eye of round and in the L* value for sirloin tip across time when vacuum-packed and stored at 4°C. No differences ($p<0.05$) were seen in the L*, a* and b* values for striploin across time.

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