

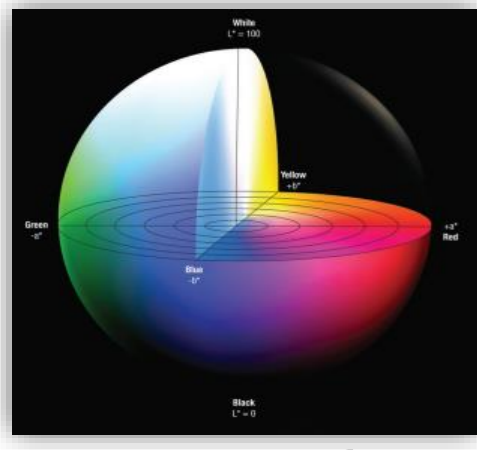
Color Dynamics in Aubrac Cattle Meat: Longissimus Dorsi Analysis at 0, 24, and 48 Hours Postmortem

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Abstract

The objective of this study was to assess the changes in meat color over time in Aubrac cattle of both genders. Specifically, the study concentrated on Longissimus Dorsi muscles, examining the color values of the meat at 0, 24, and 48 hours after death. The development of the CIE Lab* color space allows for the expression of colors in a three-dimensional system. The L*, a*, and b* values represent lightness, the red-green color component, and the yellow-blue color component, respectively. These values enable the evaluation and description of the color of a meat sample. Taking into account the overall obtained results (example: the meat color saturation recorded an average value of 14.28 ± 1.11 in males, and 17.72 ± 2.76 in females), we can appreciate that in the Aubrac cattle breed, there are significant differences between males and females, concerning all analyzed parameters regarding color (brightness, hue intensity, color intensity of the meat, color saturation, and Hue index) observed in the anatomical region under study.

Introduction

The Aubrac cattle breed is one of the most well-known and appreciated beef cattle breeds. This breed, known for its superior meat quality, has a long history and originates from the Aubrac region in southern France. Aubrac cattle's adaptability to different growing conditions is one of their strengths. These animals are accustomed to grazing in mountainous and hilly areas, which gives them good resistance to harsh climates and difficult terrains.

The Longissimus dorsi muscle (Sirloin) represents an exceptionally valuable muscle in beef processing, renowned for its remarkable organoleptic qualities such as tender texture and intense flavor.

The color of meat is assessed by observing it externally and in cross-section. Initially, it is determined whether it is characteristic of the respective species. The color of meat can vary from pale pink to dark red, depending on the type of muscle. The intensity and shade of the color are determined by the content of myoglobin, hemoglobin, and the chemical state of the pigment in the muscle. Within the same species, the color of the meat can be influenced by various factors, such as age, health status, physiological condition of the animal before slaughter, and meat storage conditions.

Materials and methods

The research was initiated by forming a herd of Aubrac cattle, including both males and females. After slaughter, 30 samples were collected from the carcasses obtained from Aubrac breed animals, and the color analysis of the Longissimus Dorsi muscle (Sirloin) was conducted.

In the process of perceiving the color of meat, all these parameters are objectively expressed through the light emitted by the muscle tissue towards the viewing object, which describes the color through five coordinates: L, a, b, C, and h°.

The determination of the color of beef samples was performed using the Konica Minolta Chroma Meter CR-410. The device is a reflection spectrophotometer capable of measuring the color of the sample using colorimetric scales such as XYZ, Yxy, Lab*, Hunter Lab, LCh, and Munsell. The development of the CIE Lab* color space allows for expressing colors in a three-dimensional system. The values L*, a*, and b* represent brightness, the red-green color component, and the yellow-blue color component, respectively. These values enable the evaluation and description of a meat sample's color.

Table 1. Results regarding the brightness of the meat

Maturation time	Gender	M. Longissimus Dorsi		
		X ± SD	Min.	Max.
L* - 0 h	M	32.99 ± 0.81 ^y	31.94	34.51
	F	35.94 ± 0.94 ^x	34.85	37.45
L* - 24 h	M	33.73 ± 0.66 ^y	32.78	34.78
	F	35.61 ± 0.33 ^x	35.25	36.34
L* - 48 h	M	34.73 ± 0.59 ^x	33.71	35.64
	F	35.35 ± 0.41 ^x	34.83	36.18
OVERALL	M	33.82 ± 0.99 ^y	31.94	35.64
	F	35.63 ± 0.65 ^x	34.83	37.45

Table 2. Results regarding the hue of the meat

Maturation time	Gender	M. Longissimus Dorsi		
		X ± SD	Min.	Max.
a* - 0 h	M	12.25 ± 0.63 ^y	11.11	13.83
	F	14.23 ± 0.41 ^x	13.69	15.75
a* - 24 h	M	13.83 ± 0.42 ^y	13.09	14.55
	F	15.75 ± 0.29 ^x	15.24	16.24
a* - 48 h	M	13.83 ± 0.47 ^y	13.00	14.56
	F	19.73 ± 0.76 ^x	18.36	20.90
OVERALL	M	13.31 ± 0.91 ^y	11.11	14.56
	F	16.57 ± 2.41 ^x	13.69	20.90

Table 3. Results regarding the color intensity of the meat

Maturation time	Gender	M. Longissimus Dorsi		
		X ± SD	Min.	Max.
a* - 0 h	M	12.25 ± 0.63 ^y	11.11	13.83
	M	4.04 ± 0.78 ^y	2.68	5.29
b* - 0 h	F	5.32 ± 0.28 ^x	4.86	5.67
	M	6.42 ± 0.28 ^x	6.06	7.02
b* - 24 h	F	5.17 ± 0.20 ^y	4.99	5.52
	M	4.81 ± 0.40 ^y	4.05	5.46
b* - 48 h	F	8.28 ± 0.53 ^x	7.52	9.22
	M	5.09 ± 1.13 ^y	2.68	7.02
OVERALL	M	5.09 ± 1.13 ^y	2.68	7.02

Table 4. Results regarding the color saturation (Chroma) of the meat

Maturation time	Gender	M. Longissimus Dorsi		
		X ± SD	Min.	Max.
C* - 0 h	M	12.92 ± 0.61 ^y	11.54	14.12
	F	15.19 ± 0.46 ^x	14.61	15.83
C* - 24 h	M	15.26 ± 0.41 ^y	14.57	15.86
	F	16.57 ± 0.30 ^x	16.04	17.12
C* - 48 h	M	14.65 ± 0.47 ^y	13.68	15.26
	F	21.40 ± 0.75 ^x	20.01	22.48
OVERALL	M	14.28 ± 1.11 ^y	11.54	15.86
	F	17.72 ± 2.76 ^x	14.61	22.48

Table 5. Results regarding the hue of meat color (Hue index)

Maturation time	Gender	M. Longissimus Dorsi		
		X ± SD	Min.	Max.
H° - 0 h	M	71.74 ± 3.49 ^x	66.36	78.16
	F	69.50 ± 0.70 ^y	68.29	70.63
H° - 24 h	M	65.09 ± 1.15 ^y	63.15	67.12
	F	71.82 ± 0.62 ^x	70.55	72.76
H° - 48 h	M	70.83 ± 1.57 ^x	68.25	73.95
	F	67.23 ± 1.43 ^y	64.91	69.43
OVERALL	M	69.22 ± 3.73 ^x	63.15	78.16
	F	69.52 ± 2.13 ^x	64.91	72.76

Conclusions

It is important to recognize the economic and nutritional value of cattle and beef, as well as to promote sustainability and food safety in this industry. Thus, the Aubrac cattle breed can be the best option for beef producers, considering the specificity of consumer demand.

My study fills a relatively unexplored research area regarding the quality of meat from Aubrac cattle. The findings are useful for researchers seeking a better understanding of these aspects. Additionally, they bring new perspectives on the subject, enriching existing knowledge.

Results and discussions

In the course of the conducted research, Table 1 illustrates that the brightness level recorded in the M. Longissimus dorsi muscle in males exhibits significant differences between 0 (32.99 ± 0.81^y) hours and 48 (34.73 ± 0.59^x) hours post-slaughter,

while in females, the differences are non-significant regarding the brightness level recorded at 0 (35.94 ± 0.94^x), 24 (35.61 ± 0.33^x), and 48 hours (35.35 ± 0.41^x). Also, regarding the overall, significant differences were recorded between the meat color obtained from males (33.82 ± 0.99^y) compared to that obtained from females (35.63 ± 0.65^x).

Sanudo C. et al. reported a value of 14.12 ± 1.22 for the hue of the meat obtained from Aubrac cattle in 1997. Regarding the hue (a*) of the meat obtained from the Aubrac breed (Table 2), it is noted that the mean values recorded in the M. Longissimus dorsi muscle in males exhibit significant differences between 0 (12.25 ± 0.63^y) hours and 48 hours post-slaughter (13.83 ± 0.47^y), while in females, the differences are significant regarding the hue recorded at 0 (14.23 ± 0.41^x), 24 (15.75 ± 0.29^x), and 48 hours (35.35 ± 0.41^x). Additionally, significant differences were observed in the overall comparison of meat color obtained from males versus females.

Regarding the color intensity (b*) of the meat obtained from the Aubrac breed (Table 3), it is observed that the average values recorded in the M. Longissimus dorsi muscle in males show significant differences between 0, 24, and 48 hours post-slaughter, while in females, the differences are significant regarding the color intensity at 48 hours compared to 0 and 24 hours. Taking into account the overall obtained result, we can appreciate that in the Aubrac cattle breed, there are significant differences between males and females regarding the observed color intensity.

Regarding the color saturation (C*) of the meat obtained from the Aubrac breed (Table 4), it is observed that the average values recorded in the M. Longissimus dorsi muscle, regardless of sex, show significant differences between 0, 24, and 48 hours post-slaughter. Taking into account the overall obtained result, we can appreciate that in the Aubrac cattle breed, there are significant differences between males and females regarding the saturation of the color observed in the studied muscle. The results regarding color saturation in Aubrac cattle can provide important information about the quality and visual appearance of the meat, contributing to its characterization and evaluation within the beef industry.

Regarding the hue (H°) of the meat color obtained from the Aubrac breed (Table 5), it is observed that the average values recorded in the M. Longissimus dorsi muscle in females show significant differences at 0, 24, and 48 hours post-slaughter. In males, significant differences are observed between the average values obtained at 24 hours (65.09°), compared to those recorded at 0 hours (71.74°) and 48 hours (70.83°).