

# Evaluating pH in Aubrac Cattle meat: Longissimus Dorsi & Semitendinosus at 0, 24, & 48 Hrs

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## Abstract

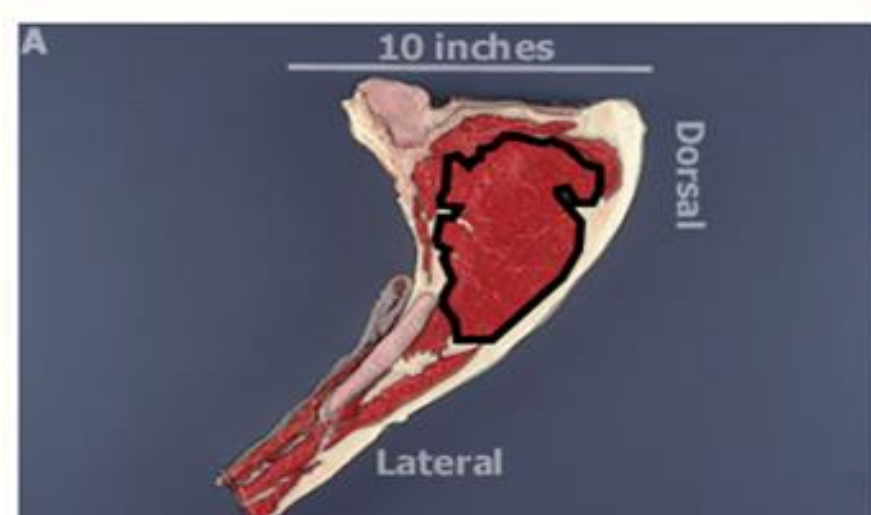
This study aimed to measure the pH of meat from both male and female Aubrac cattle. The study focused on the M. Semitendinosus and M. Longissimus Dorsi muscles, comparing the pH values of the meat recorded at 0, 24, and 48 hours postmortem. Regarding the acidity of M. Longissimus Dorsi in males, significant differences were observed between the average pH values at 0, 24, and 48 hours post-slaughter, with a slight decrease in the average from 6.05 at 0 hours to 5.5 at 48 hours. Similarly, significant differences were observed in females between the average pH values of M. Longissimus Dorsi at 0, 24, and 48 hours post-slaughter. Analyzing the acidity of M. Semitendinosus, significant differences were observed in both sexes between the average pH values at 0, 24, and 48 hours post-slaughter; for example, in males, average values ranging from 5.99 to 5.50 were obtained. In conclusion, these results highlight that the sex of the cattle influenced the average pH value at 0 hours for both muscle categories, collected from Aubrac cattle.

## Introduction

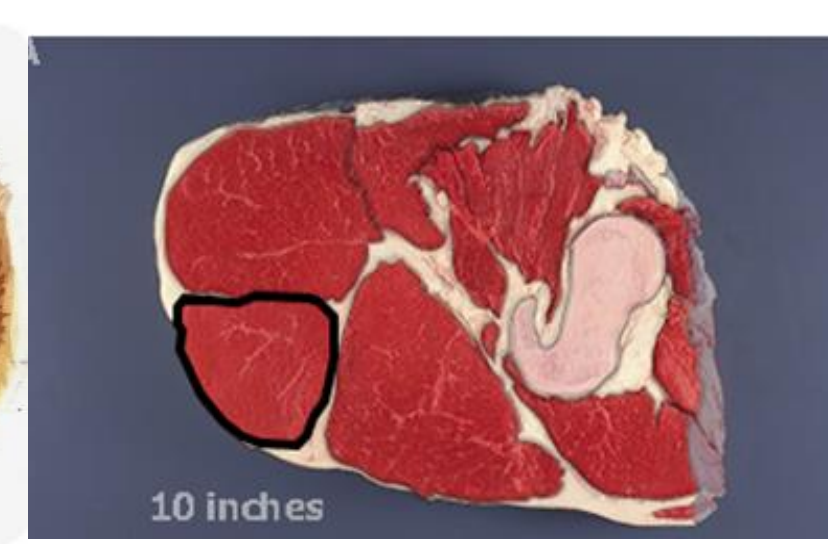
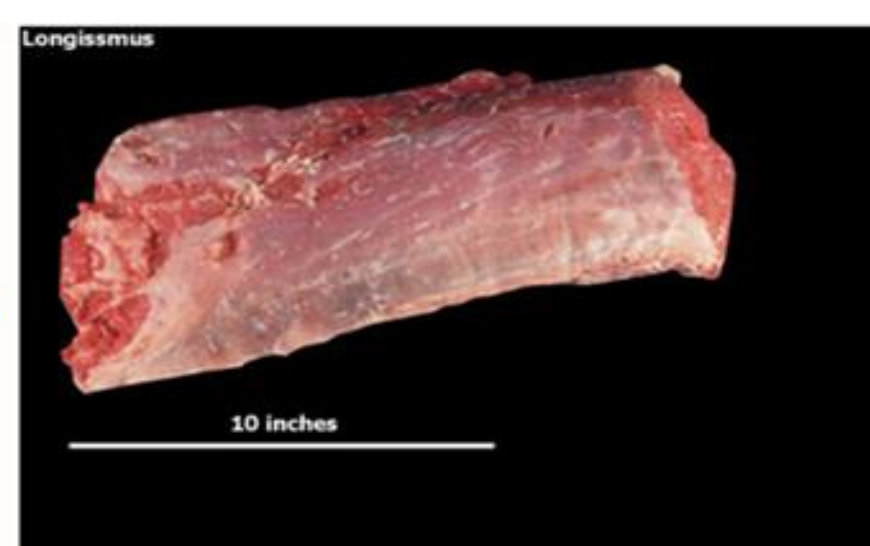
The Aubrac cattle breed is one of the most highly regarded meat breeds globally, with origins rooted in the mountainous Aubrac region in southern France. These cattle are known for their distinctive traits, which make them highly prized in the meat industry.

The Longissimus dorsi muscle (Sirloin) is located on the dorsal side of cattle's back and is part of the group of back muscles. It is one of the most valuable meat muscles, being used in many culinary preparations due to its tender texture and rich taste. This muscle is usually cut into larger pieces, such as ribeye steak or filet mignon, and is considered one of the most delicious parts of the animal.

The Semitendinosus is another important muscle located in the posterior part of the animal's thigh. It is part of a group of thigh muscles and is involved in leg movement and support. From a culinary perspective, the Semitendinosus is also a valuable source of meat, appreciated for its juicy taste and soft texture. It is used in a variety of preparations, such as roast beef or beef tenderloin, adding richness and flavor to different dishes.



M. Longissimus dorsi



M. Semitendinosus



## Materials and methods

At the moment of animal slaughter, the process of ending its life leads to the accumulation of lactic acid in the muscle fibers as a result of anaerobic metabolism, and the characteristic muscular pH level of a healthy and rested animal ranges between 7 and 7.3. After slaughter, the decrease in pH value is caused by ATP degradation, resulting in pH values between 5.4 and 5.5. The speed of this decline is influenced by species, muscle type, temperature, and various stressors. In this research, the potentiometric method was used to determine the pH of beef. The potentiometric method involves measuring the potential difference between a glass electrode and a reference electrode placed in the analyzed sample, with this potential difference varying linearly with pH. The equipment used, called a pH meter, is equipped with a scale directly graduated in pH units (Figure 1). These devices use a single compound electrode, which is inserted into the analyzed solution and can be either fixed for laboratory use or portable for field analyses.

The working method involves the use of actual meat or meat extract, with its preparation involving the cleaning of the meat from connective tissue and fat, followed by the fine chopping of the samples. Determining the pH with a special pH meter inserted into the meat sample is a straightforward yet precise process. Calibration is essential: before use, the pH meter must be calibrated using known pH buffer solutions to ensure measurement accuracy. Sample preparation involves taking a known quantity of meat and placing it in a suitable container, such as a laboratory glass or glass vessel. It's crucial to homogenize the sample to ensure accurate pH measurement. Electrode insertion follows: the pH meter electrodes, connected to the measuring device, are then inserted into the meat sample. One of the electrodes is a specialized glass electrode that detects pH variations in the sample. Measurement of pH: after the electrodes are placed in the sample, the measuring device displays the pH value on the screen. To obtain an accurate measurement, the electrodes must be stable and not exposed to external disturbances. Results interpretation: the pH value displayed on the screen represents the acidity or alkalinity of the meat sample. Depending on the obtained value and the pH range associated with meat quality, an assessment of the sample's quality and condition can be made. It's important to follow the manufacturer's instructions and perform measurements under appropriate conditions to ensure the accuracy and reliability of the results. According to the specialized literature, the pH value interpretation range for beef is 5.5–6.0 for fresh meat and 6.0–6.7 for relatively fresh meat.



## Results and discussions

Table 1. Results regarding the pH of Longissimus Dorsi

Maturation time	Gender	M. Longissimus Dorsi		
		X ± SD	Min.	Max.
pH - 0 h	M	6.05 ± 0.04 <sup>y</sup>	5.99	6.12
	F	6.11 ± 0.05 <sup>x</sup>	6.03	6.18
pH - 24 h	M	5.60 ± 0.02 <sup>x</sup>	5.58	5.63
	F	5.61 ± 0.03 <sup>x</sup>	5.55	5.65
pH - 48 h	M	5.50 ± 0.02 <sup>x</sup>	5.47	5.53
	F	5.47 ± 0.02 <sup>y</sup>	5.45	5.51
OVERALL	M	5.72 ± 0.24 <sup>x</sup>	5.47	6.12
	F	5.73 ± 0.28 <sup>x</sup>	5.45	6.18

x & y: There are no significant differences (P > 0.05) between any two means within the same column indexed by the same letter. pH – the acidity of meat; M - males, F - females

Table 2. Results regarding the pH of Semitendinosus muscle

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

x & y: There are no significant differences (P > 0.05) between any two means within the same column indexed by the same letter. pH – the acidity of meat; M - males, F - females

According to the animals' sex, Table 1 highlights the obtained pH means for the Longissimus Dorsi muscle at 0 h, 24 h, and 48 h. Regarding the acidity of M. Longissimus dorsi in males, significant differences are observed between the average pH values at 0, 24, and 48 hours post-slaughter, with a slight decrease in the mean from 6.05 at 0 h to 5.5 at 48 h.

Additionally, significant differences are noted in females as well between the average pH values of M. Longissimus dorsi at 0, 24, and 48 hours post-slaughter. These results highlight that the sex of the cattle influenced the average pH value at 0 hours for the muscle group under study.

Sanudo C. et al. rigorously recorded a value of 5.59 for the pH levels of meat sourced from Aubrac cattle in their comprehensive study conducted in 1997.

Analyzing the acidity of the M. Semitendinosus, it is observed that, in both sexes, there are significant differences between the average pH values at 0, 24, and 48 hours post-slaughter. For example, in males, average values ranging between 5.99 and 5.50 were obtained.

Similarly, in the case of the M. Deltoid, it is observed that, in both sexes, there are significant differences between the average pH values at 0, 24, and 48 hours post-slaughter.

The results highlighted in Table 2 provide a detailed overview of the acidity dynamics in the Semitendinosus muscle, collected from carcasses of Aubrac cattle, with the average values falling within the ranges described in the specialized literature.

## Conclusions

In conclusion, pH is a crucial parameter in meat quality assessment, influencing various aspects such as texture, taste, color, and shelf life. Understanding pH dynamics in meat can provide valuable insights into the physiological changes occurring post-slaughter and during storage, aiding in the evaluation of meat freshness and quality. Monitoring and managing pH levels accurately are essential for ensuring the production of high-quality meat products that meet consumer expectations and safety standards.