RESEARCH REGARDING CATTLE MEAT TENDERNESS SLAUGHTERED IN N-E OF ROMANIA

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Abstract

Identifying the factors that offers and give an influence to the cattle meat tenderness caught the attention of many researchers because tenderness is considered to be one of the most important physical and organoleptic characteristics thereof. Tenderness and other parameters related to the texture of the meat are directly associated with myofibrillar protein structure, connective tissue content and the interaction between them.

In order to assess the Warner Bratzler shear forces were studied four groups (youth and adults ♂, respectively youth and adult ♀) from which were harvested 4 groups of muscle tissue (Longissimus dorsi m., Semitendinosus m, Trapezius thoracis m., Biceps brahial m.).

Necessary equipment for Warner Bratzler shear forces determination is represented by a monolamelar texturometer TA Plus Lloyd Instruments.

Varying according to age of the animals, so on the collagen quantity that exist in the muscle and by the types of muscle fibers composing it, the tenderness of the muscles analyzed were significant differences between groups from females compared to the males, females being represented by the lowest values of shear forces.

Key words: muscle fibers, shear forces, tenderness

INTRODUCTION

Tenderness can be described at the level of sensory perception as a process in which when the mastication take place it feel his texture, its resistance to teeth pressure and its adhesion. Variations of cattle meat tenderness can be attributed to the animal's age, sex, live weight, breed and stress before slaughter. For example, the meat quickly chilled immediately after slaughter have strongly contracted muscle fibers and causes the resulting phenomenon of "cold shortening" which requires greater shear forces of the fibers after preparation. [2]

Thus, if the meat is tough, it takes more force to shear, which is known under the name of Warner-Bratzler shear force (WBSF).

Tenderness is a function of collagen content, stability to heat and myofibrils of muscle structure. [3] This appears to be influenced mainly by the growth rate of cattle than to their breed.

Meat from cattle that was fed on pastures is characterized by a higher shear force applied, than those raised in the conventional system. Sarcomere length, connective tissue and the proteolysis explain most variations that occurred in the maturation of meat, proteolysis being the main factor that contributed to the tenderness of the meat. [1]

Many researchers have found that differences between WBSF values were found more in carcasses having a weight less than the big ones of the same breed.

MATERIAL AND METHODS

In order to determine the physical parameter of the meat, the initial samples packaged in polyethylene were subjected to boiling for 45 minutes. Subsequently, they were wrapped in aluminum foil and were held at refrigeration temperatures (4°C) for 24 hours. It followed the meat cutting in 3

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cylinders with a diameter of 1.5 cm and 2 cm length in the sense of the muscle fibers.

The equipment required to measure the Warner Bratzler shear forces is represented by a texturometer monolamelar Plus Lloyd TA Instruments, which has a blade that moves at a speed of 100 mm / min, where the cutting force is 1000 N.

Muscle samples were sectioned cylindrical in perpendicular direction of the muscle fibers the maximum force required sectioning the sample being followed as an indicator for describing the meat tenderness. For the determination of the forces, the device is provided with a rigid flat surface, such as rectangular sectioned at the center and three blades in various forms: a blade in the form of a square and the two in "V" form.

RESULTS AND DISCUSSIONS

Calculating the statistic estimators of cattle meat tenderness measured by shear forces Warner Bratzler, we can appreciate the characteristics of each muscle through the differences in the muscle fibers. Thus, of the four muscle groups analyzed, m. *Longissimus dorsi* recorded the lowest average values (39.22 ± 0.81 N / cm^2), for which it can be classified as the most tender of them. (Tab. 1)

The calculated coefficient of variation indicates a good to medium homogeneity character, because he ranging from 5.08 to 11.91%.

The average values recorded for *Biceps brahial* muscle ranged between 73.00 ± 1.31 N / cm^2 and 81.01 ± 1.47 N / cm^2 that reflect upper averages for shear forces retrieved for other groups.

From Table 1 it can be seen that the shear forces increased with age, for which there were significant differences between L1 - L3 and L2 - L4 (Tab. 2) and significant differences respectively significantly distinct between L1 - L2 and L3 - L4 (Tab. 3).

Table1 Statistics estimators of cattle meat tenderness

Specification		Analyzed lots	n	Calculated statistical indicators			
				$\bar{X} \pm s_{\bar{x}}$	V%	Min.	Max.
Warner Brtzler Shear Force (N/cm^2)	*Longissimus dorsi M.*	L1	10	42.25±0.96	7.18	37.12	45.63
		L2		39.22±0.81	6.53	35.41	43.68
		L3		48.12±0.91	6.03	43.15	51.23
		L4		53.35±1.56	9.26	45.25	60.94
	Semitendinosus M.	L1		52.38±1.97	11.91	42.75	61.24
		L2		59.30±1.64	8.75	51.23	65.49
		L3		62.04±0.99	5.08	58.47	67.64
		L4		65.91±1.22	5.88	60.09	71.23
	Trapezius thoracis M.	L1		37.13±2.05	9.67	57.15	73.36
		L2		70.25±1.95	8.79	61.06	77.23
		L3		73.27±1.97	8.52	59.94	79.64
		L4		75.72±1.70	7.13	67.31	81.34
	Biceps brahial M.	L1		73.00±1.31	5.71	68.15	79.64
		L2		77.09±1.40	5.75	68.79	82.13
		L3		79.45±2.02	8.07	68.79	86.64
		L4		81.01±1.47	5.75	70.93	86.13

L1=youth ♀; L2=youth ♂; L3=♀ adult; L4=♂ adut

Table 2 Significance of differences between the averages for *Longissimus dorsi M.* WBSF, male and female of different ages

Sex	Category	SIGNIFICANCE
♀	youth vs. adults	$\hat{F} = 19.54$; $F_{0.001} = 15.38$; $\hat{F} > F_{0.001}$ => ***
♂	youth vs. adults	$\hat{F} = 64.40$; $F_{0.001} = 15.38$; $\hat{F} > F_{0.001}$ => ***

Table 3 Significance of differences between the averages for *Longissimus dorsi M.* WBSF in young cattle and adult cattle of different sexes

Category	Sex	SIGNIFICANCE
youth	♀ vs. ♂	$\hat{F} = 5.81$; $F_{0.05} = 4.41$; $\hat{F} > F_{0.05}$ => *
adults	♀ vs. ♂	$\hat{F} = 8.30$; $F_{0.01} = 8.28$; $\hat{F} > F_{0.01}$ => **

Varying according to age of the animals, so on the quantity of existing collagen in the muscle and muscle fiber types that compose it, tenderness for Semitendinosus m. showed significant differences between L1 - L3 and distinctly significant between L2- L4. (Tab. 4)

Table 4 Significance of differences between the averages for *Semitendinosus M.* WBSF, male and female of different ages

Sex	Category	SIGNIFICANCE
♀	youth vs. adults	$\hat{F} = 19.10$; $F_{0.001} = 15.38$; $\hat{F} > F_{0.001}$ => ***
♂	youth vs. adults	$\hat{F} = 10.39$; $F_{0.01} = 8.28$; $\hat{F} > F_{0.01}$ => **

For similar age groups, but differentiated by sex were significant differences (Tab. 5) due *Semitendinosus* muscles that differ in structure and composition from male to female.

For *Trapezius thoracis* muscle was registered a minimum average shear forces of 37.13± 2.05 N / cm2, represented by female youth group, which by comparison with the average registered in adult (73.27 ± 1.97 N / cm2) resulted an significant differences (Tab. 6)

Table 5 Significance of differences between the averages for *Semitendinosus M.* WBSF in young cattle and adult cattle of different sexes

Category	Sex	SIGNIFICANCE
youth	♀ vs. ♂	$\hat{F} = 7.26$; $F_{0.05} = 4.41$; $\hat{F} > F_{0.05}$ => *
adults	♀ vs. ♂	$\hat{F} = 5.97$; $F_{0.05} = 4.41$; $\hat{F} > F_{0.05}$ => *

Table 6 Significance of differences between the averages for *Trapezius thoracis M.* WBSF, male and female of different ages

Sex	Category	SIGNIFICANCE
♀	youth vs. adults	$\hat{F} = 4.64$; $F_{0.05} = 4.41$; $\hat{F} > F_{0.05}$ => *
♂	youth vs. adults	$\hat{F} = 4.43$; $F_{0.05} = 4.41$; $\hat{F} > F_{0.05}$ => *

Table 7 Significance of differences between the averages for *Trapezius thoracis M.* WBSF in young cattle and adult cattle of different sexes

Category	Sex	SIGNIFICANCE
youth	♀ vs. ♂	$\hat{F} = 1.21$; $F_{0.05} = 4.41$; $\hat{F} < F_{0.05}$ => n.s
adults	♀ vs. ♂	$\hat{F} = 0.87$; $F_{0.05} = 4.41$; $\hat{F} < F_{0.05}$ => n.s

The same dynamics have muscles harvested from young males, which compared with those collected and analyzed by adults show a statistically significant difference.

Through statistical analysis of differences between *Biceps brahial* muscles groups analyzed for Warner Bratzler shear forces values were observed statistical differences between L1 - L3 and between L1- L2. (Tab. 8, Tab. 9)

Table 8 Significance of differences between the averages for *Biceps brahial M.* WBSF, male and female of different ages

Sex	Category	SIGNIFICANCE
♀	youth vs. adults	$\hat{F} = 7.10$; $F_{0.05} = 4.41$; $\hat{F} > F_{0.05}$ => *
♂	youth vs. adults	$\hat{F} = 3.69$; $F_{0.05} = 4.41$; $\hat{F} < F_{0.05}$ => n.s

Table 9 Significance of differences between the averages for *Biceps brahial M.* WBSF in young cattle and adult cattle of different sexes

Category	Sex	SIGNIFICANCE
youth	♀ vs. ♂	$\hat{F} = 4.52$; $F_{0.05} = 4.41$; $\hat{F} > F_{0.05}$ => *
adults	♀ vs. ♂	$\hat{F} = 0.38$; $F_{0.05} = 4.41$; $\hat{F} < F_{0.05}$ => n.s

CONCLUSIONS

Considering the data retrieved for shear forces applied to each muscle group, we can see that the *Longissimus dorsi* muscle recorded lower values, which he characterized as the most tender of them. Also, depending on the degree of development of tissues in the carcasses, we see that female values are lower compared to those in the muscles from males.

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