

Research on Nutritive Value of Main Muscle Groups from Cattle

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Abstract

Aim of this study was to characterize meat quality through the chemical composition of three muscles taken from three cattle breeds specialized on milk and meat production, by gender, which have not been subjected to a process of conditioning before slaughter. Longissimus dorsi, Semimembranosus, Trapezius thoracis muscles were characterized through protein, lipid and water composition. The higher content of proteins was found in Trapezius thoracis muscle from Fleckvieh females. The lower content of lipid and water was found in Semimembranosus muscle from Black spotted Romanian males, respectively in Longissimus dorsi muscle from Black spotted Romanian females. Meat obtained has a poor quality, which revealed the need of refurbishment of these animals before slaughter.

Keywords: chemical composition, muscle, cattle, breed

1. Introduction

Modern consumers' preoccupation is represented by healthy foods, with a high content of nutrients and a low content of fats [1]. This thing has resulted from the increased consciousness and demand of consumers, who expect food characterized by special dietetic or health properties [2].

The quality of beef is affected by the sex of the animal, which significantly influences carcass and meat quality. Bull carcasses are characterized by higher meat content with simultaneous lower content of fat compared to heifer carcasses [3]. In Romania the slaughtered cows belong mainly to breeds design for milk production, consequently the obtained carcasses are characterized by lower slaughter and quality parameters. The resulting nutritional, technological, sensory and culinary meat quality is dependent on a number of factors [4, 5].

The objective of this study was to characterize the composition of major muscles of beef carcasses according to breed and sex of the animal.

2. Materials and Methods

A group of 33 animals (19 females and 14 males) was used for the evaluation. The cattle belong to Fleckvieh and Pinzgauer and Black spotted Romania breed, which were slaughtered for sale as cut portions. The cattle were classified according to their gender; any other factor was not taken into account since we refer to cattle sold on the current markets.

From these animals muscle samples were taken. The muscular tissue was represented by Longissimus dorsi, Semimembranosus and Trapezius thoracis.

The muscle samples were collected after the operations included in the slaughter and refrigeration flow were performed.

The measurements were performed at 24 hours after cutting the half-carcass in different anatomical regions and about 5 to 6 days after slaughter. Meat samples of about 100 g were properly packaged, labeled and transported in cold conditions to the laboratory for analysis.

The automatic meat analyzer is an infrared spectrophotometer that is used for composition analysis, using infrared absorbance characteristics of

the sample spectra (Fig. 1). Data collected from the conducted research were processed using tabular MsExcel computing applications. Usual statistical estimators were calculated.



Figure 1. Automatic meat analyzer

3.Results and discussion

Results on the chemical characteristics of Longissimus dorsi revealed differences on protein, lipid and water content (Table 1). The content of proteins in Longissimus dorsi muscle taken from females varied between the minimum of 21,20% at Black spotted Romanian breed and the maximum of 22,20% at the same breed.

At males the protein content limits were 21,20% (Black spotted Romanian) and 22,40 (Pinzgauer). Analyzed through homogeneity the protein content presented values for the variation coefficient below 10%, specific value for a high homogeneity. The average value for the protein levels was higher in males than females, variations domains being 21,65% (Black spotted Romanian) and 21,83% (Pinzgauer) in males and 21,52% (Black spotted Romanian) and 21,70% (Fleckvieh) in females. Males presented lower levels of lipids than females, with one exception at Fleckvieh breed which has had a content of 2,73% in males and 2,57% in females. In Longissimus dorsi muscle the minimum content of lipids has been 1,90% at Fleckvieh and Black spotted Romanian females and the maximum 3,50% at Pinzgauer males. Longissimus dorsi muscle presented a low homogeneity of the studied population regarding lipid content. Water content varied inversely to the lipid one. This parameter varied between the average values of 74,61% (Black spotted Romanian) and 75,24% (Pinzgauer) in females muscles and 75,4% (Fleckvieh) and 75,7% (Black spotted Romanian) in males muscles. Variation coefficient for water content has had values below 10%, the population being characterized through a high homogeneity.

Table 1. Chemical composition of Longissimus dorsi muscle from cattle

Specification		Cattle sex					
		Female			Males		
		F ¹	P ²	BSR ³	F ¹	P ²	BSR ³
Number of animals		5	5	9	5	4	5
Protein (%)	$\bar{x} \pm s_{\bar{x}}$	21,70±0,18	21,58±0,07	21,52±0,12	21,77±0,07	21,83±0,23	21,65±0,28
	s	0,61	0,16	0,35	0,15	0,46	0,64
	V%	2,86	0,76	1,61	0,70	2,10	2,94
	Min÷Max	21,30÷22,10	21,40÷21,80	21,20÷22,20	21,60÷21,90	21,30÷22,40	21,20÷22,10
Lipid (%)	$\bar{x} \pm s_{\bar{x}}$	2,57±0,29	2,64±0,26	3,47±0,37	2,73±0,20	2,38±0,38	2,15±0,22
	s	0,65	0,59	1,11	0,45	0,76	0,49
	V%	25,35	22,18	32,15	16,50	32,14	23,02
	Min÷Max	1,90÷3,20	2,00÷3,30	1,90÷5,30	2,30÷3,20	1,80÷3,50	1,80÷2,50
Moisture (%)	$\bar{x} \pm s_{\bar{x}}$	74,97±0,46	75,24±0,16	74,61±0,35	75,40±0,27	75,53±0,33	75,70±0,32
	s	1,02	0,36	1,04	0,61	0,65	0,71
	V%	1,36	0,48	1,40	0,81	0,86	0,93
	Min÷Max	73,80÷75,70	74,60÷75,50	73,10÷76,00	75,00÷76,10	74,60÷76,10	75,20÷76,20

1 = Fleckvieh cattle;

2 = Pinzgauer cattle;

3 = Black spotted Romanian cattle.

Table 2. Chemical composition of Semimembranosus muscle from cattle

Specification		Cattle sex					
		Female			Males		
		F ¹	P ²	BSR ³	F ¹	P ²	BSR ³
Number of animals		5	5	9	5	4	5
Protein (%)	$\bar{x} \pm s_{\bar{x}}$	21,83±0,14	21,84±0,07	21,77±0,07	21,77±0,14	21,80±0,20	21,75±0,28
	s	0,32	0,15	0,20	0,31	0,41	0,64
	V%	1,47	0,69	0,92	1,40	1,87	2,93
	Min÷Max	21,60÷22,20	21,70÷22,10	21,50÷22,10	21,50÷22,10	21,20÷22,10	21,30÷22,20
Lipid (%)	$\bar{x} \pm s_{\bar{x}}$	2,50±0,43	2,30±0,14	2,30±0,21	2,43±0,46	2,40±0,86	1,85±0,47
	s	0,96	0,32	0,64	1,03	1,71	1,06
	V%	38,57	13,75	28,01	42,18	71,28	57,33
	Min÷Max	1,40÷3,20	2,00÷2,80	1,40÷3,10	1,30÷3,30	1,20÷4,90	1,10÷2,60
Moisture (%)	$\bar{x} \pm s_{\bar{x}}$	75,23±0,14	75,64±0,14	75,70±0,19	75,57±0,37	75,33±0,66	75,75±0,41
	s	0,31	0,31	0,57	0,83	1,31	0,92
	V%	0,41	0,41	0,75	1,10	1,75	1,21
	Min÷Max	74,90÷75,50	75,30÷76,10	75,00÷76,50	74,90÷76,50	73,50÷76,60	75,10÷76,40

1 = Fleckvieh cattle;

2 = Pinzgauer cattle;

3 = Black spotted Romanian cattle.

Table 3. Chemical composition of Trapezius thoracis muscle from cattle

Specification		Cattle sex					
		Female			Males		
		F ¹	P ²	BSR ³	F ¹	P ²	BSR ³
Number of animals		5	5	9	5	4	5
Protein (%)	$\bar{x} \pm s_{\bar{x}}$	22,03±0,09	21,60±0,09	21,66±0,07	21,67±0,03	21,55±0,09	21,65±0,03
	s	0,21	0,20	0,22	0,06	0,17	0,07
	V%	0,94	0,93	1,04	0,27	0,80	0,33
	Min÷Max	21,80÷22,10	21,30÷21,80	21,40÷22,10	21,60÷21,70	21,40÷21,80	21,60÷21,70
Lipid (%)	$\bar{x} \pm s_{\bar{x}}$	2,40±0,29	2,20±0,04	2,49±0,18	2,60±1,12	2,43±0,34	2,75±0,22
	s	0,66	0,10	0,55	0,26	0,68	0,49
	V%	27,32	4,55	22,05	10,18	28,25	18,00
	Min÷Max	1,70÷3,00	2,10÷2,30	1,70÷3,20	2,40÷3,10	2,40÷2,90	1,90÷3,40
Moisture (%)	$\bar{x} \pm s_{\bar{x}}$	75,43±0,09	75,52±0,09	75,44±0,19	75,53±0,25	75,53±0,31	75,80±0,25
	s	0,21	0,19	0,57	0,55	0,62	0,57
	V%	0,28	0,25	0,76	0,73	0,82	0,75
	Min÷Max	75,20÷75,60	75,20÷75,70	74,70÷76,30	75,00÷76,10	74,70÷76,00	75,40÷76,20

1 = Fleckvieh cattle;

2 = Pinzgauer cattle;

3 = Black spotted Romanian cattle.

Obtained data on the chemical characteristics of Semimembranosus muscle revealed a higher content in proteins with relatively close values between the studied breed (Table 2). Variation coefficients of the studied parameters of Semimembranosus muscle calculated for each breed by cattle sex presented a high homogeneity of the studied populations ($V < 10\%$), with one exception observed in the case of lipid content which has had a high variation ($V > 10\%$).

The minimum value for the content of proteins was observed at Black spotted Romanian breed both in females and males. Males presented lower average values for the protein levels. Lipid percentage in Semimembranosus muscle was higher at females than males. This chemical parameter varied between 1,10% at Black spotted Romanian and 4,90% at Pinzgauer breed, both in males. Regarding the water content of Semimembranosus muscle recorded a minimum value of 73,50% and a maximum of 76,60%, both found at Pinzgauer males.

For all breeds regardless the sex of animals, average water content has been above 75%.

Trapezius thoracis muscle presented a minimum of average protein content of 21,60% (Pinzgauer) and a maximum of 21,66% (Black spotted Romanian) in females, and a minimum of 21,55% (Pinzgauer) and the maximum of 21,65% (Black spotted Romanian) in males. The values of variation coefficient below 10% revealed a high homogeneity of the protein content for all breeds. The limits of this parameter variation had been between 21,30% (Pinzgauer) and 22,10% (Fleckvieh and Black spotted Romanian breeds) in females and 21,40% and 21,80% at males both values been recorded at Pinzgauer breed (Table 3). In this study the lipid content of Trapezius thoracis muscle presented higher values at the males design for both milk and meat production in comparison with females. Lipid content presented values of variation coefficient higher than 10%, with one exception at Pinzgauer females. The average content of lipid varied between 2,2% (Pinzgauer) and 2,49% at Black spotted Romanian breed in females and 2,43% at Pinzgauer breed and 2,75% at Black spotted Romanian in males. Muscle taken from males presented higher water content than female muscle. Variation coefficient analysis revealed a very good homogeneity for the water content for all breeds.

4. Conclusion

A large variation was observed in the chemical attributes of cattle muscles. Processors may use these data to identify muscles which exhibit characteristics they desire for certain meat products.

Analysis of chemical composition of meat revealed the influence of sex, race, anatomical positioning of the muscle. The higher content of proteins was found in Trapezius thoracis muscle from Fleckvieh females. The lower content of lipid and water was found in Semimembranosus muscle from Black spotted Romanian males, respectively in Longissimus dorsi muscle from Black spotted Romanian females. Meat obtained has a poor quality, which revealed the need of refurbishment of these animals before slaughter.

Compliance with Ethics Requirements

Authors declare that they respect the journal's ethics requirements. Authors declare that they have no conflict of interest and all procedures involving human and/or animal subjects (if exists) respect the specific regulations and standards.

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