

STUDY ON THE INFLUENCE OF SEX AND BREED ON BOVINE MEAT QUALITY

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Received 25 March 2012, accepted 22 May 2012

Abstract: *The purpose of this study is to analyze the variations in chemical composition of two muscle groups collected from three bovine breeds. The biological material was represented by the Gluteus and Semimembranosus muscles collected from bovine of Fleckvieh, Pinzgauer and Black spotted Romanian breed. The average protein content from Gluteus muscle ranged between 21.46% at the muscle collected from the Pinzgauer females and 21.83% at the males from the same breed. The average lipid content in Gluteus muscle has been above 2.0% in all breeds. The Semimembranosus muscle presented a minimum average protein content of 21.75% at the muscle collected from Black spotted Romanian breed and a maximum of 21.84% at Pinzgauer breed. The lipid content from Semimembranosus muscle varied between 1.85% at the Black spotted Romanian males and 2.50% at Fleckvieh breed. For both muscles there have not been obtained significant differences for the two parameters studied according to the sex of the animal. The breed has influenced the lipid content from the Gluteus muscle collected from females. Analysis of chemical composition of meat revealed the influence of sex, race, anatomical positioning of the muscle. Meat obtained has a poor quality, which revealed the need of refurbishment of these animals before slaughter.*

Keywords: *muscle, protein content, lipid content, breed*

1. Introduction

Meat is an important component in human nutrition, providing through its composition the essential nutrients that the organism needs for a balanced diet.

Animal sex has important implications on all meat production, both during growth and development and also on the further processing [1].

Commercial processing of cattle meat is under dual dependence of quantitative (weight) and qualitative criteria regarding the carcass and muscle composition. The quality of muscle groups depends on their lipid and protein composition [2].

Proteins are basic and functional components, influencing the textural, sensory and nutritional properties [3].

Lipids play an important role in the diet because the linoleic and linolenic acids are present as polyunsaturated [4].

The breed influences both the quantitative production of meat and the carcass composition, respectively the main muscle groups [5].

The purpose of this study was to analyze the basic chemical composition of two muscles collected from three bovine breeds slaughtered for the current human consumption, although the breeds aren't specialized for meat production.

2. Experimental

The research material used was represented by bovines, belonging to races Fleckvieh, Pinzgauer and Black spotted

Romanian, 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 Gluteus and Semimembranosus muscles.

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).



Figure 1. Automatic meat analyzer

Data collected from the conducted research were processed using tabular MsExcel computing applications. Usual statistical estimators were calculated. Anova analysis was used to determine the influence of the sex factor on the variation of protein and lipid muscle content. To determine the differences between the races of the same sex Fisher test was used. For the data we have found distinct differences at the Fisher test we have applied the Student test to determine the pairs that caused these differences.

3. Results and Discussion

The proportion of protein content participation in the chemical composition of Gluteus muscle presented values that ranged between 21.46% at the Pinzgauer

females and 21.83% at the males from the same breed (table 1). The homogeneity of the protein content was very good, the values found for the variation coefficient being below 10%.

Table 1
Estimators of chemical composition (%) of Gluteus muscle, depending on bovines sex and breed

Specification		Bovine sex					
		Females			Males		
		BA ¹	P ²	BNR ³	BA ¹	P ²	BNR ³
n		5	5	9	5	4	5
Proteins (%)	$\bar{x} \pm s_{\bar{x}}$	21.67±0.09	21.46±0.09	21.68±0.06	21.60±0.04	21.83±0.17	21.60±0.06
	s	0.38	0.21	0.19	0.10	0.33	0.14
	V%	1.75	0.97	0.86	0.46	1.51	0.65
	Min÷Max	21.50÷21.90	21.20÷21.70	21.40÷22.00	21.30÷22.00	21.40÷22.20	21.50÷21.70
Lipids (%)	$\bar{x} \pm s_{\bar{x}}$	2.00±0.27	2.48±0.31	2.62±0.21	2.80±0.18	2.43±0.43	2.80±0.13
	s	0.61	0.69	0.63	0.40	0.85	0.28
	V%	30.41	27.70	24.10	14.29	35.21	10.10
	Min÷Max	1.60÷2.70	2.10÷3.70	1.70÷3.50	2.40÷3.20	1.90÷3.70	2.60÷3.00

Note: 1 bovines Fleckvieh breed, 2 bovines Pinzgauer breed, 3 bovines Black spotted Romanian breed.

The minimum value of the protein content was obtained at the Pinzgauer females (21.20%) and the maximum at the males from the same breed (22.20%). After data analyses of the average protein content it has been observed that at females it has been, in general, lower than the one obtained at males, with the exception of Fleckvieh breed. The lipid content presented a high variability between the individuals of the same breed, but also

between breeds (table 1). The variation limits of the lipid content were 1.60% at the Fleckvieh females and 5.50% at the females from the Black spotted Romanian breed. Females presented, in general higher values than males. Statistical interpretation of the obtained results for the protein and lipid muscle content has not revealed statistical differences between the two sexes (table 2).

Table 2
The significance of differences in chemical composition (%) of Gluteus muscle recorded in bovines between the sexes based on race

Chemical parameter (%)	Significance
Proteins	BA ¹ : $\hat{F} = 0.25$; $F_{5\%}(1;8) = 5.32$; $\hat{F} < F_{5\%} \Rightarrow ns$ P ² : $\hat{F} = 4.15$; $F_{5\%}(1;7) = 5.59$; $\hat{F} < F_{5\%} \Rightarrow ns$ BNR ³ : $\hat{F} = 0.30$; $F_{5\%}(1;12) = 4.75$; $\hat{F} < F_{5\%} \Rightarrow ns$
Lipids	BA ¹ : $\hat{F} = 3.62$; $F_{5\%}(1;8) = 5.32$; $\hat{F} < F_{5\%} \Rightarrow ns$ P ² : $\hat{F} = 0.01$; $F_{5\%}(1;7) = 5.59$; $\hat{F} < F_{5\%} \Rightarrow ns$ BNR ³ : $\hat{F} = 0.14$; $F_{5\%}(1;12) = 4.75$; $\hat{F} < F_{5\%} \Rightarrow ns$

Note: 1 bovines Fleckvieh breed, 2 bovines Pinzgauer breed, 3 bovines Black spotted Romanian breed, NS not significant ($P < 0.05$), * $P > 0.05$, ** $P > 0.01$, *** $P > 0.001$

The results of Fisher test showed that between the females of different breeds regarding the proteins content there are no

significant differences and significant for the lipid content. At males the obtained differences were not significant for all the studied parameters (table 3).

Table 3
Analysis of the significance of values differences recorded by the chemical composition (%) of Gluteus muscle in bovines, based on race by sexes

Chemical parameter (%)	Significance
Proteins	F ¹ : $\hat{F} = 2.12$; $F_{5\%}(3;20) = 3.10$; $\hat{F} < F_{5\%} \Rightarrow ns$ M ² : $\hat{F} = 0.92$; $F_{5\%}(2;11) = 3.98$; $\hat{F} < F_{5\%} \Rightarrow ns$
Lipids	F ¹ : $\hat{F} = 3.71$; $F_{5\%}(3;20) = 3.10$; $F_{1\%}(3;20) = 4.94$; $F_{5\%} < \hat{F} < F_{1\%} \Rightarrow *$ M ² : $\hat{F} = 0.36$; $F_{5\%}(2;11) = 3.98$; $\hat{F} < F_{5\%} \Rightarrow ns$

Note: F females, M males, NS not significant, * significant

Table 4
Student test results on lipid content (%) in Gluteus muscle in females

Rasa	Average	P ²	BNR ³	BA ¹
		2.48	2.62	3.72
BA ¹	3.72	$\hat{t} = 1.98$; $t_{5\%} = 1.90$; $t_{1\%} = 3.00$; $t_{5\%} < \hat{t} < t_{1\%} \Rightarrow *$	$\hat{t} = 2.69$; $t_{5\%} = 1.78$; $t_{1\%} = 2.68$; $t_{0.1\%} = 3.93$; $t_{1\%} < \hat{t} < t_{0.1\%} \Rightarrow **$	
BNR ³	2.62	$\hat{t} = 0.25$; $t_{5\%} = 1.80$; $\hat{t} < t_{5\%} \Rightarrow ns$		
P ²	2.48			

Note: 1 bovines Fleckvieh breed, 2 bovines Pinzgauer breed, 3 bovines Black spotted Romanian breed, NS not significant, * significant, ** distinct significant.

In order to determine the female breeds between these differences appear the Student test was applied. There were found not significant differences between the pairs Pinzgauer – Black spotted Romanian, significant between Pinzgauer – Fleckvieh and between Black spotted Romanian – Fleckvieh distinct significant.

The data on the chemical characteristics of the Semimembranosus muscle revealed a protein content with relatively closed values between the studied breeds. The protein content showed a high homogeneity of the studied populations ($V\% < 10\%$) (table 5). The minimum of the

protein content was found at Pinzgauer males (21.20%) and the maximum at the Fleckvieh females and Black spotted Romanian males (22.20%). The variation of the average lipid content was between 1.85% at the Black spotted Romanian males and 2.50% at the Fleckvieh females (table 5). The lipid percentage, like the one of proteins, at the Semimembranosus muscle was higher at females than males, with the exception of Pinzgauer breed that presented an average value with 0.10% higher at males than females (table 5).

Table 5
Estimators of chemical composition (%) of Semimembranosus muscle, depending on bovine sex and breed

Specification		Bovine sex					
		Females			Males		
		BA ¹	P ²	BNR ³	BA ¹	P ²	BNR ³
n		5	5	9	5	4	5
Proteins (%)	$\bar{x} \pm s_{\bar{x}}$	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
Lipids (%)	$\bar{x} \pm s_{\bar{x}}$	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
	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

Note: 1 bovine Fleckvieh breed, 2 bovine Pinzgauer breed, 3 bovine Black spotted Romanian breed.

The statistical comparison of the studied bovine populations belonging to the two

sexes showed not significant differences for the protein and lipid content (table 6).

Table 6
The significance of differences in chemical composition (%) of Semimembranosus muscle recorded in bovines between the sexes based on race

Chemical parameter (%)	Significance
Proteins	BA ¹ : $\hat{F} = 0.07$; $F_{5\%}(1;8) = 5.32$; $\hat{F} < F_{5\%} \Rightarrow ns$ P ² : $\hat{F} = 0.04$; $F_{5\%}(1;7) = 5.59$; $\hat{F} < F_{5\%} \Rightarrow ns$ BNR ³ : $\hat{F} = 0.005$; $F_{5\%}(1;12) = 4.75$; $\hat{F} < F_{5\%} \Rightarrow ns$
Lipids	BA ¹ : $\hat{F} = 0.006$; $F_{5\%}(1;8) = 5.32$; $\hat{F} < F_{5\%} \Rightarrow ns$ P ² : $\hat{F} = 0.02$; $F_{5\%}(1;7) = 5.59$; $\hat{F} < F_{5\%} \Rightarrow ns$ BNR ³ : $\hat{F} = 0.67$; $F_{5\%}(1;12) = 4.75$; $\hat{F} < F_{5\%} \Rightarrow ns$

Note: 1 bovine Fleckvieh breed, 2 bovine Pinzgauer breed, 3 bovine Black spotted Romanian breed, NS not significant ($P < 0.05$), * $P > 0.05$, ** $P > 0.01$, *** $P > 0.001$

Table 7
Analysis of the significance of values differences recorded by the chemical composition (%) of Semimembranosus muscle in bovines, based on race by sexes

Chemical parameter (%)	Significance
Proteins	F ¹ : $\hat{F} = 2.87$; $F_{5\%}(3;20) = 3.10$; $\hat{F} < F_{5\%} \Rightarrow ns$ M ² : $\hat{F} = 0.01$; $F_{5\%}(2;11) = 3.98$; $\hat{F} < F_{5\%} \Rightarrow ns$
Lipids	F ¹ : $\hat{F} = 3.06$; $F_{5\%}(3;20) = 3.10$; $\hat{F} < F_{5\%} \Rightarrow ns$ M ² : $\hat{F} = 0.12$; $F_{5\%}(2;11) = 3.98$; $\hat{F} < F_{5\%} \Rightarrow ns$

Note: F females, M males, NS not significant.

The results of Fisher test showed that between the females and males of different breeds for the chemical parameters studied

the differences were not significant (table 7).

4. Conclusion

Analysis of chemical composition of meat revealed the influence of sex, race, anatomical positioning of the muscle.

The lipid content varied around 2.50% depending on race, sex and muscle.

The chemical parameters that define the chemical composition of Semimembranosus muscle had not varied significant.

Meat obtained has a poor quality, which revealed the need of refurbishment of these animals before slaughter.

5. References

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