

RESEARCH ON THE CORRELATIONS BETWEEN PROTEIN BLOOD PROFILE AND MUSCLE PROTEIN CONTENT IN BOVINES

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Abstract

Interpretation of the physiological status of bovines by means of blood biochemistry gives us information about the animal, the husbandry and maintenance technologies used, whose consequences are reflected on meat quality. The purpose of this study was to analyze the protein blood profile and muscle proteins in bovines. 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. From these animals blood and muscle samples were taken. The muscular tissue was represented by Longissimus dorsi, Semimembranosus, Triceps brachii, Rhomboideus muscle. The concentration of total blood proteins ranged from 9.38 g/dL in Pinzgauer females and 12.99 g/dL in Fleckvieh females. Blood albumin showed values of 5.53 g/dL in Fleckvieh males and 3.37 g/dL in Black Spotted Romanian females. Muscle protein content was higher at the Black Spotted Romanian race, both males and females, in the Triceps brachii and Rhomboideus muscles. The analysis of the obtained values indicates that at the bovines with high concentrations of total blood protein and albumin had a lower percentage of muscle protein.

Key words: bovine, total blood protein, albumin, muscle tissue, muscle proteins

INTRODUCTION

Animal welfare is a major considered in the production of meat [1]. Determining the physiological status of cattle by blood biochemistry analysis provides information on animal, the growth system and the maintenance technology used, whose consequences are reflected directly on meat quality. The knowledge of bovine meat quality is important both in terms of consumption and the impact on human health [2].

The level of blood metabolites indicates the proportion of energetic metabolism, of proteins and other nutrients in animals [3].

MATERIAL AND METHODS

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 blood and muscle samples were taken. The muscular tissue was represented by Longissimus dorsi, Semimembranosus, Triceps brachii, Rhomboideus muscle.

In the undertaken researches for the venous blood collection we have used a Vacutainer S-Manovette closed system, vacuum technique, in which the tube is evacuated before harvest, eliminating the risk of vacuum loss. This system provides a constant proportion of collected blood-additive, causing it to obtain accurate results. Blood collection was done from the jugular and mammary vein.

The volume of blood collected to carry out the research was 4 to 5 mL blood for the usual biochemical investigations.

The blood is allowed to clot.

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

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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.

Biochemical parameters were determined using ACCENT 200 device, which is a projected biochemistry system designed for quantitative determinations in vitro from serum, plasma, urine or cerebrospinal fluid (Fig. 1).



Fig. 1 Automatic biochemical analyzer

The automatic meat analyzer is an infrared spectrophotometer that is used for composition analysis, using infrared absorbance characteristics of the sample spectra (Fig. 2).

Data collected from the conducted research were processed using tabular MsExcel computing applications. Usual statistical estimators were calculated.



Fig. 2 Automatic meat analyzer

RESULTS AND DISCUSSIONS

In order to analyze bovine metabolism total blood protein concentration was studied. Change in total protein according to the sex of cattle is contained in Table 1, observing that the lowest average value was determined in Pinzgauer breed females (9.38 g/dL).

The minimum in total blood protein concentration was found in females of Pinzgauer race (7.53 g/dL), while the maximum value was obtained at the females of Black Spotted Romanian breed (13.85 g/dL). In our research total blood protein concentration showed averages higher than those mentioned in the literature (7.0÷7.9 g/dL). This increase is the imprint left by the stress accumulated during cattle housing and recreation, but also of the anxiety acquired before entering the space for stunning.

Total protein showed a maximum average amount of 12.99 g/dL in females of Fleckvieh breed and a minimum of 10.33 g/dL obtained at the males of the same breed (Table 1). Regarding the concentrations determined in males it was observed a difference of 0.04 g/dL between the Fleckvieh and Pinzgauer breed.

Table 1 Influence of cattle sex on the amount of total proteins (g/dL)

Specification	Bovine sex					
	Females			Males		
	Fleckvieh	Pinzgauer	Black Spotted Romanian	Fleckvieh	Pinzgauer	Black Spotted Romanian
n	5	5	9	5	4	5
$\bar{x} \pm s_{\bar{x}}$	12.99±0.93	9.38±0.82	12.37±0.68	10.33±0.72	10.37±0.59	11.56±0.12
s	2.08	1.84	2.03	1.62	1.18	0.26
V%	16.01	19.57	16.43	15.69	11.37	2.26
Min÷Max	11.26÷15.30	7.53÷11.90	8.04÷13.85	8.98÷12.13	9.01÷11.70	11.37÷11.74

Albumin had a mean concentration of 3.37 g/dL in females of Black Spotted Romanian breed and 4.84 g/dL in males of the same breed (Table 2). The minimum this character was found in females of Black Spotted Romanian breed (1.24 g/dL) and the maximum in males of Fleickveih breed (5.61 g/dL).

The standard deviation of the mean presented the lowest value at the males of Black Spotted Romanian breed (0.01 g/dL), the maximum value was represented by 0.43 g/dL obtained at the females from the same breed. In our research albumin concentrations were not within the limits mentioned in the literature (2.8÷3.9 g/dL). The analysis of the coefficients of variation showed a high

homogeneity of the population of cattle studied (V% <10%), with one exception obtained at the females of Black Spotted Romanian breed (V% = 38.07 %) (Table 2).

Average quantities of albumin were higher in males than females, so the males of Fleickveih breed showed a mean value of 5.53 g/dL and females only 4.12 g/dL (Table 2). Females showed that albumin concentration ranged from 3.37 g/dL (Black Spotted Romanian breed) and 4.12 g/dL (Fleickveih breed). In males the maximum of average concentration of albumin was obtained at the same breed as in females (5.53 g/dL), while the minimum was found at Pinzgauer breed (4.65 g/dL).

Table 2 Influence of cattle sex on the amount of blood albumin (g/dL)

Specification	Bovine sex					
	Females			Males		
	Fleickveih	Pinzgauer	Black Spotted Romanian	Fleickveih	Pinzgauer	Black Spotted Romanian
n	5	5	9	5	4	5
$\bar{x} \pm s_{\bar{x}}$	4.12±0.17	3.95±0.21	3.37±0.43	5.53±0.04	4.65±0.25	4.84±0.01
s	0.38	0.46	1.28	0.09	0.51	0.01
V%	9.12	11.73	38.07	1.64	10.96	0.29
Min ÷ Max	3.73÷4.48	3.45÷4.42	1.24÷4.71	5.43÷5.61	4.13÷5.21	4.83÷4.85

Regarding the average content of proteins of Triceps brachial muscle, analyzed in terms of its homogeneity, the studied parameter had a very good homogeneity in studied cattle (V% <10%) (Table 3). Maximum percentage of protein in females was found at Pinzgauer breed (22.20%), three males presented values that ranged from 21.20% (race Pinzgauer) and 22.10% (Black Spotted Romanian breed).

Average values of protein content in Triceps brachial muscle were higher at the mil breed compared with the mixed ones both at females and males (Table 3). Average protein content ranged from 21.63% in females of Fleickveih breed at 21.74% in Black Spotted Romanian breed, Pinzgauer breed females had a higher percentage of 0.01% than the Fleickveih breed. Males showed a minimum of 21.57% at the Fleickveih breed and a maximum of 21.8% in Black Spotted Romanian breed.

Data on the chemical characteristics of Semimembranosus muscle revealed protein content between the studied breeds relatively

close (Table 3). The coefficients of variation of the chemical parameter determined in each breed according to cattle sex showed a high homogeneity of the studied populations (V%<10).

The percentage of protein found in females presented a maximum of 22.20% Fleickveih breed. Males showed higher limits of variations than females, ranging from 21.20% at the Pinzgauer breed to 22.20% at the Romanian Black Spotted breed (Table 3).

The Fleickveih breed presented values of muscle protein content of 21.07% in Rhomboideus muscle in females and 20.80% in males, while the Black Spotted Romanian breed had a percentage of 21.77% and 21.65% (table 3). The analysis highlights the values of the coefficient of variation below 10% specific to a good uniformity of the studied character (percentage of protein). Mean percentages determined show the superiority of the values determined at males compared with females, except the Fleickveih breed who presented a higher content in females (21.07%) than males.

The obtained results on Longissimus dorsi muscle chemical characteristics revealed differences in protein content (Table 3). Protein content in Longissimus dorsi muscle collected from males ranged from 21.20% (Black Spotted Romanian breed) and 22.40% (Pinzgauer breed) (Table 3). Analyzed in terms of its homogeneity, the percentage of

protein presented values of the coefficient of variation below the threshold of 10%.

The average protein content was higher in males than females, the ranges being 21.65% (Black Spotted Romanian breed) and 21.83% (Pinzgauer breed) in males and 21.52% (Black Spotted Romanian breed) and 21.70% (Fleickveih breed) in females.

Table 3 The content in proteins of different muscle groups (%)

Specification		Bovine sex					
		Females			Males		
		Fleickveih	Pinzgauer	Black Spotted Romanian	Fleickveih	Pinzgauer	Black Spotted Romanian
n		5	5	9	5	4	5
M. Triceps brachii	$\bar{X} \pm s_{\bar{x}}$	21.63±0.17	21.64±0.17	21.74±0.06	21.57±0.17	21.73±0.19	21.80±0.19
	s	0.38	0.37	0.19	0.38	0.39	0.42
	V%	1.75	1.72	0.86	1.76	1.78	1.95
	Min÷Max	21.20÷21.90	21.30÷22.20	21.40÷21.90	21.30÷22.00	21.20÷22.10	21.50÷22.10
M. Semimembranos	$\bar{X} \pm s_{\bar{x}}$	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
M. Rhomboid	$\bar{X} \pm s_{\bar{x}}$	21.07±0.49	21.10±0.28	21.77±0.05	20.80±0.48	21.13±0.58	21.65±0.03
	s	1.10	0.62	0.16	1.08	1.16	0.07
	V%	5.23	2.92	0.73	5.20	5.50	0.33
	Min÷Max	19.80÷21.80	20.40÷21.80	21.40÷21.90	19.90÷22.00	19.40÷21.90	21.60÷21.70
M. Longissimus dorsi	$\bar{X} \pm s_{\bar{x}}$	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

CONCLUSIONS

Cattle that have high concentrations of blood total protein and albumin had a lower percentage in muscle protein in most cases.

Muscle protein content was higher in Black Spotted Romanian breed, both males and females in the Triceps brachial muscles and Rhomboideus.

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