EFFECTS OF AGE, SEX AND BREED ON BIOCHEMICAL BLOOD PARAMETERS OF CATTLE AT SLAUGHTERHOUSE

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Abstract

The aim of this study was comparison of blood biochemical parameters according to age, sex and breed in cattle. Blood samples from 33 Fleckvieh, Pinzgauer and Black Spotted Romanian breed at different age (less and more than 2 years), sex (male and female) were taken, transported to the analyzing laboratory, serum was obtained and analyzed with "Accent 200" blood analyzer. The biochemical parameters analysis (total protein, albumin, triglycerides, cholesterol, glucose, uric acid, urea, amylase, aspartate transaminase, alanine amino transferase, alkali phosphatase, calcium, inorganic phosphorus, magnesium and iron) leads to the metabolic and functional interpretation of the physiological status before slaughter with consequences on meat quality. The values obtained were statistically analyzed; the mean and standard deviations were calculated. The obtained results lead to a biochemical characterization of the blood biochemical indicators, highlighting the differences between the breed groups and allow the possibility of metabolic status interpretation through the presented values dynamic.

Key words: cattle, blood biochemistry, age, sex, breed

INTRODUCTION

Interpretation of the physiological status of bovines through blood biochemical methods provide information's regarding animal, growth and maintenance technologies of which consequences are reflected on meat quality. The body as a biological system, for the normal course of his functions, needs a variety of substances (essential amino acids, carbohydrates, lipids, vitamins, mineral substances, water) which he procures from the environment [4].

Blood is essential for the survival of multicellular organisms. It is necessary for the transport of oxygen, water, electrolytes, nutrients, and hormones in the organs of excretion [2].

The research in meat production domain is based on determining the quality of muscle tissue, missing the data on the physiological status of the animals before slaughter. The determination of blood biochemical parameters in different bovine breeds allows the physiological status interpretation in order to characterize the productive future of these individuals.

Changes in haematological and biochemical blood indicators of various cattle categories are well known [1, 5, 9, 13].

Changes in indicators of the internal environment of farm animals reflect the actual metabolic processes. Indicators of metabolic and mineral blood profile can be used for objective and reliable evaluations of the nutritional status of cattle [7, 10, 12]. The objective of the present study was to characterize the changes in indicators of the internal environment in the process of cattle slaughter.

MATERIAL AND METHOD

For this study, jugular vein blood samples from Fleckvieh (F), Pinzgauer (P) and Black Spotted Romanian (BSR) breed cattle at different age (less and more than 2 years), sex (male and female) were used. The cattle were raised on family farms in northeastern part of Romania and showed no clinical signs of disease at the sanitary-veterinary control before slaughter.

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Blood samples were collected from jugular vein using 21G 1½˝ needles in vacuum system in cuvettes. Blood was allowed to clot; serum was obtained following a centrifugation, stored at 4-6°C and transported to the laboratory for analysis. The blood plasma was analyzed for the content of total protein (TP), albumin (AL), triglycerides (Tri), cholesterol (Chol), glucose (Glu), uric acid, urea, amylase, aspartate transaminase (AST), alanine amino transferase (ALT), alkali phosphatase (ALP), calcium (Ca), inorganic phosphorus (P), magnesium (Mg) and iron (Fe). The analysis was performed by automatic analyzer Accent 200. Differences in mean percentages and concentrations of the variables between breeds, sex and ages have been statistically processed running the ANOVA single factor algorithm.

RESULTS

Effects of breed on blood biochemical values of cattle are presented in Table 1. Albumin, triglycerides, glucose, uric acid, urea, amylase, alanine amino transferase and phosphorus levels of the three breeds were not significantly different ($p > 0.05$); this indicated that breed had not any influence on these parameters

Table 1 The comparison of some biochemical parameters in different cattle breeds

Indicators	Breed		
	F	P	BSR
n	6	9	11
TP (g/dL)	11.66 ± 0.90^{ac}	9.81 ± 0.52^{a}	12.22 ± 0.55^{c}
AL (g/dL)	48.23 ± 3.30	42.59 ± 1.94	42.35 ± 2.31
Tri (mg/dL)	11.47 ± 1.32	10.57 ± 2.16	13.85 ± 1.53
Chol (mg/dL)	89.08 ± 10.87^{a}	99.06 ± 7.59^{a}	133.28 ± 6.61^{c}
Glu (mg/dL)	101.57 ± 35.99	87.0 ± 9.50	92.31 ± 10.74
Uric acid (mg/dL)	1.11 ± 0.10	0.95 ± 0.05	1.17 ± 0.08
Urea (mg/dL)	16.05 ± 3.30	19.78 ± 2.59	18.09 ± 2.85
Amylase (U/L)	25.95 ± 3.20	24.67 ± 2.93	21.01 ± 2.76
AST (U/L)	105.10 ± 14.63^{a}	56.60 ± 8.00^{c}	64.02 ± 8.80^{b}
ALT (U/L)	41.10 ± 7.81	30.24 ± 4.07	33.42 ± 3.36
ALP (U/L)	124.93 ± 15.86^{a}	86.18 ± 13.29$^{a.b}$	73.37 ± 11.11^{b}
Ca (mg/dL)	10.26 ± 0.25^{b}	10.55 ± 0.23^{d}	8.94 ± 0.30^{a}
P (mg/dL)	6.62 ± 0.58	7.63 ± 0.96	7.96 ± 0.50
Mg (mg/dL)	3.79 ± 0.41$^{a.b}$	4.26 ± 0.54^{a}	3.10 ± 0.21^{b}

F-Fleckvieh, P-Pinzgauer, BSR-Black Spotted Romanian
TP-total protein, AL-albumin, Tri-triglycerides, Chol-cholesterol, Glu-glucose, AST-aspartate transaminase, ALT-alanine amino transferase, ALP-alkali phosphatase, Ca-calcium, P-inorganic phosphorus, Mg-magnesium, Fe-iron
ANOVA significance, superscripts within the same row, between experimental groups:
no superscript = no statistical significance for the differences between means;
ab = significant differences between means;
ac = distinguished significant differences between means;
ad = very significant differences between means.

The comparison of some normal biochemical parameters according to age (youth and adult) is presented in Table 2.

The comparison of some normal biochemical parameters according to sex (male and female) is shown in Table 3.

Table 2 The comparison of some biochemical parameters according age

Indicators	Age	
	Youth (less than 2 years)	Adult (more than 2 years)
n	15	11
TP (g/dL)	10.57 ± 0.51[a]	12.27±0.55[b]
AL (g/dL)	35.00 ± 3.60[a]	45.76±1.77[c]
Tri (mg/dL)	13.55 ± 1.62	11.13±1.34
Chol (mg/dL)	127.69 ± 7.05[a]	99.64±7.54[b]
Glu (mg/dL)	78.48 ± 8.44	99.69±14.53
Uric acid (mg/dL)	1.18 ± 0.08	1.00±0.05
Urea (mg/dL)	15.33 ± 2.29	21.09±2.42
Amylase (U/L)	22.01 ± 3.07	23.31±1.65
AST (U/L)	63.55 ± 9.49	76.47±9.24
ALT (U/L)	31.67 ± 3.65	36.31±3.82
ALP (U/L)	68.84 ± 9.76[a]	104.75±11.01[b]
Ca (mg/dL)	8.79 ± 0.23[a]	10.55±0.15[d]
P (mg/dL)	7.55 ± 0.36	7.26±0.62
Mg (mg/dL)	3.04 ± 0.20[a]	4.06±0.36[b]

TP-total protein, AL-albumin, Tri-triglycerides, Chol-cholesterol, Glu-glucose, AST-aspartate transaminase, ALT-alanine amino transferase, ALP-alkali phosphatase, Ca-calcium, P-inorganic phosphorus, Mg-magnesium, Fe-iron

ANOVA significance, superscripts within the same row, between experimental groups:
no superscript = no statistical significance for the differences between means;
ab = significant differences between means;
ac = distinguished significant differences between means;
ad = very significant differences between means.

Table 3:The comparison of some biochemical parameters according sex

Indicators	Sex	
	Male	Female
n	9	17
TP (g/dL)	10.61 ± 0.40	11.60 ± 0.57
AL (g/dL)	4.98 ± 0.17[a]	3.67 ± 0.24[c]
Tri (mg/dL)	11.23 ± 1.51	12.65 ± 1.39
Chol (mg/dL)	100.11 ± 11.83	117.12 ± 6.16
Glu (mg/dL)	119.81 ± 23.52[a]	78.21 ± 5.68[b]
Uric acid (mg/dL)	1.01 ± 0.04	1.12 ± 0.07
Urea (mg/dL)	22.11 ± 2.97	16.14 ± 1.83
Amylase (U/L)	23.67 ± 2.56	23.28 ± 2.27
AST (U/L)	85.10 ± 11.30	63.43 ± 7.90
ALT (U/L)	33.50 ± 4.72	34.41 ± 3.37
ALP (U/L)	126.50 ± 11.92[a]	70.22 ± 7.54[d]
Ca (mg/dL)	10.45 ± 0.21[a]	9.46 ± 0.28[b]
P (mg/dL)	8.55 ± 0.92	7.01 ± 0.36
Mg (mg/dL)	4.17 ± 0.53	3.39 ± 0.22

TP-total protein, AL-albumin, Tri-triglycerides, Chol-cholesterol, Glu-glucose, AST-aspartate transaminase, ALT-alanine amino transferase, ALP-alkali phosphatase, Ca-calcium, P-inorganic phosphorus, Mg-magnesium, Fe-iron

ANOVA significance, superscripts within the same row, between experimental groups:
no superscript = no statistical significance for the differences between means;
ab = significant differences between means;
ac = distinguished significant differences between means;
ad = very significant differences between means

In this study, the comparison of biochemical parameters according age (youth and adult) indicated that the level of triglycerides, glucose, uric acid, urea, amylase, aspartate transaminase, alanine amino transferase and phosphorus were not significant different ($p > 0.05$). The values of total proteins and cholesterol were significantly lower in adults than youth. The levels of alkali phosphatase and magnesium were significantly lower in youth than adults.

As shown in Table 2 calcium level in youth was significantly lower than adults.

As shown in Table 3, the glucose and calcium levels were significant higher in males than female cattle. There were very significant differences in alkali phosphatase between males and female. Amylase level was significantly lower in male than female. In this study the total proteins showed higher levels than those reported in other studies, this may be due to stress conditions before slaughter and cattle anxiety before stunning.

DISCUSSION

According to breed in Pinzgauer the level of total proteins and cholesterol were significantly lower than Black spotted Romanian breed. The level of blood calcium was significantly lower in Black spotted Romanian breed and very significantly low in Fleckvieh than Pinzgauer.

Total protein levels are lower in young animals and higher in mature animals whilst albumin levels are lower at youth and increased in adult [11]. In this study, the difference of amylase level between the two groups was statistically distinguished significant. In both groups urea and albumin increased with age. Serum albumin is a very sensitive and early nutritional indicator of protein status [3]. One of the main functions of calcium and inorganic phosphorus is their involvement in skeletal growth in young animals. In older animals there is a decreased need for calcium and inorganic phosphorus. Aspartate aminotransferase levels increased with age, these results are similar to those reported by other studies [6].

The values of triglycerides were lower in this study than other researches due to some permanent weight loss of cattle, fact revealed by the poor corporal state. Increased glucose concentrations in blood have been correlated positively with stressful condition. Similar results were found in this study where increased glucose concentrations were obtained at the holding pens at the abattoir. This increased may be due to the stress accumulated during the period of transportation and off-loading. It appears that the animals actually experienced trauma during the period being held in the holding pens at the abattoir.

Urea presented higher values than other studies; this fact may be due to dehydration and some renal diseases. Some cattle categories presented lower or higher values of AST and ALT then the values from other studies [8]. All of these enzymes have predominantly intracellular action and thus, under normal conditions, the serum activity is very low or absent, any increase in their activity would be evidence of damage in the tissue in which they are lodged.

CONCLUSIONS

The present study describes the reference values of cattle breeds often slaughter in Romania, although they are primarily raised as lactating cows and after a period they are slaughter for meat production. The obtained values showed the influence of ante mortem stress on these cattle.

By dividing the animals according to sex, breed and age the range of reference values narrowed leads to a more sensitive diagnosis. There were significant differences in blood concentrations of most analytes measured.

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