



Original Contribution

**BREED-, AGE- AND GENDER-RELATED PARTICULARITIES OF
COMPLEMENT ACTIVITY IN BULGARIAN LOCAL SHEEP
BREEDS IN SPRING SEASON**

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ABSTRACT

The studies were performed in the spring of 2008 on 66 sheep, 54 rams and 42 female and 42 male lambs. Investigations were carried out on 6 sheep, 6 rams at the age of 2-4 years, 6 female and 6 male lambs at the age of 3-5 months from the following breeds: Karakachan, Tsigay, Replyan, Panagyurishte, Copper-red Shoumen, Karnobat, Pleven Blackhead, White Maritsa and Patch-faced Maritsa, Stara Zagora and Romanov. The animals were owned by the Institute of Mountain Animal Stockbreeding and Agriculture–Troyan, the Agricultural Institutes in Karnobat and Shoumen, the Experimental Farm of the Trakia University – Stara Zagora and private farmers from Chirpan, Saedinie, Vidin and Panagyurishte.

The aim of this investigation was to study the breed, age- and gender-related particularities of complement in local sheep breeds, reared in different regions in Bulgaria during the spring season.

The highest complement concentrations were established in Panagyurishte sheep (215.24), Maritsa White (206.87) and Copper-red Shoumen (201.15) sheep whereas the lowest – in Romanov (160.23) and Pleven Blackhead – 164.09 breeds ($p < 0.01$).

For rams, highest complement activity was exhibited by Copper-red Shoumen (210.24), and the lowest – by Romanov rams 159.09 ($p < 0.01$).

With the exception of Copper-red Shoumen and Karnobat female lambs, the other ones showed APCA values higher than those of adult sheep from the respective breeds ($p > 0.05$).

Highest APCA activities had male lambs of Copper-red Shoumen and Stara Zagora breeds; lowest – Karnobat and Romanov male lambs ($p < 0.01$).

For the ovine species, there was a general trend towards lower complement concentrations in lambs at the age of 3-5 months compared to adult animals.

Key Words: Complement, Sheep breeds, Rams, Lambs

INTRODUCTION

The system of complement is an essential part of systemic mechanisms of resistance. It is a multicomponent biochemical system consisting of plasma proteins that interact each with the other in a cascade and thus provide a rapid and aggressive response. These proteins are covalently binding to the surface of microorganisms and destroy them.

The complement system could be activated by either the carbohydrate microbial structures in the absence of antibodies or by antibodies, attached to microbial cells. Thus, it plays the role of a bridge between the innate and adaptive immune responses (1).

The complement achieves a variety of defense functions, resulting in destruction (lysis) of erythrocytes, bacterial cells, viruses, virus-infected cells, neoplastic cells etc. (2, 3). The complement is also able to induce important biological reactions as agglutination, precipitation, phagocytosis and binding of C3 component, i.e. it has a functional characteristics similar to those of

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immunoglobulins (4, 5, 6).

The normal activity of complement with regard to the species, breed, age, season and the physiological state is reported for cattle (7, 8, 9), swine (10, 11, 12, 13, 14, 15, 2), rabbits (16, 2), sheep (17, 18, 19), goats (20, 21), poultry (22, 23).

Because of the scarce information in available literature, the aim of this investigation was to study the breed, age- and gender-related particularities of complement in local sheep breeds, reared in different regions in Bulgaria during the spring season.

MATERIAL AND METHODS

The studies were performed in the spring of 2008 on 66 sheep, 54 rams and 42 female and 42 male lambs. Investigations were carried out on 6 sheep, 6 rams at the age of 2-4 years, 6 female and 6 male lambs at the age of 3-5 months from the following breeds: Karakachan, Tsigay, Replyan, Panagyurishte, Copper-red Shoumen, Karnobat, Pleven Blackhead, White Maritsa and Patch-faced Maritsa, Stara Zagora and Romanov. The animals were owned by the Institute of Mountain Animal Stockbreeding and Agriculture – Troyan, the Agricultural Institutes in Karnobat and Shoumen, the Experimental Farm of the Trakia University – Stara Zagora and private farmers from Chirpan, Saedinenie, Vidin and Panagyurishte.

Blood for analysis was aseptically obtained from v. jugularis with individual needles after proper fixation of animals. The activity of the alternative pathway of complement activation (APCA) was assayed by the method of Sotirov (14).

Data were processed by one-way analysis of variance (ANOVA) with fixed effects of the factor. The effects of breed and age upon the resulting trait (APCA activity) was studied in sheep. The linear model of analysis was as followed:

$$y_{ij} = \mu + \alpha_i + \varepsilon_{ij}, \text{ where}$$

y_{ij} – values of the trait for the different variants;

μ – arithmetic mean of the entire population;

α_i – differential effects of the factor age or breed upon the analyzed trait;

ε_{ij} – random error.

The analysis was performed with the STATISTICA software (StatSoft Inc.).

RESULTS AND DISCUSSION

The APCA activities in the spring depending

on the gender, age and breed of sheep are shown in Table 1. The highest values were observed in Panagyurishte, White Maritsa and Copper-red Shoumen sheep and the lowest – in Romanov and Pleven Blackhead breeds ($p < 0.01$). Similar APCA concentrations were measured in Karnobat, Tsigay, Patched-faced Maritsa, Stara Zagora and Replyan sheep: within 180-190 CH50.

Highest complement levels were exhibited by Copper-red Shoumen rams (210.24), and the lowest – in Romanov rams – 159.09 ($p < 0.01$). Higher complement concentrations were assayed in Stara Zagora and Tsigay rams (between 183.83 and 199.62 CH50). Lower values were observed in White Maritsa, Copper-red Shoumen and Karnobat rams.

Variable concentrations of APCA were found out between sheep and rams within a breed. In Karakachan, Copper-red Shoumen, Pleven Blackhead, Patched-faced Maritsa and Stara Zagora breeds, APCA in rams was higher as compared to sheep whereas in Tsigay, Karnobat, White Maritsa and Romanov breeds, the contrary tendency was present.

Female lambs from the Pleven Blackhead, Stara Zagora and Romanov breeds exhibited the highest APCA concentrations, Copper-red Shoumen, Karnobat – lower and Karakachan – the lowest ($p > 0.05$).

With the exception of Copper-red Shoumen and Karnobat female lambs, the other ones showed APCA values higher than those of adult sheep from the respective breeds ($p > 0.05$).

Highest APCA activities were determined in male lambs of Copper-red Shoumen and Stara Zagora breeds; and the lowest – in Karnobat and Romanov male lambs ($p < 0.01$). With the exception of Pleven Blackhead and Stara Zagora breeds, male lambs had lower APCA values compared to rams of the respective breeds.

For the species in general, there was a trend towards higher complement activity in female vs male animals as well as lower APCA concentrations in lambs at the age of 3-5 months as compared to adult animals.

Age-related variations in APCA levels in cattle are reported by Grizlova et al. (24). In the serum of adult cattle, APCA ranges between 25 and 429 CH50, whereas in calves – from 24 to 256 CH50. Similar results are reported by Renshaw и Everson (25). Eckblad et al. (26) established that average serum APCA concentration in adult cows was 11.6 CH50, in calves – 51.6 CH50, and in

colostrum serum– 5.0 CH50.

Table 1. Breed-, age- and gender-related particularities of complement activity (CH50) in sheep

Breeds	n	x ± Sx	statistical significance
Sheep			
Karakachan	6	172.63 ± 12.89	abc1
Tsigay	6	187.79 ± 11.65	def2
Replyan	6	180.06 ± 13.71	ghij3
Panagyurishte	6	215.24 ± 5.22	adgklmno
Copper-red Shoumen	6	201.15 ± 8.88	bhpqr4
Karnobat	6	190.76 ± 7.50	kst15
Pleven Blackhead	6	164.09 ± 12.86	elpsvw36
White Maritsa	6	206.87 ± 13.12	civxyz25
Patch-faced Maritsa	6	183.41 ± 8.20	mwx4
Stara Zagora	6	181.75 ± 4.50	nqy6
Romanov	6	160.23 ± 7.44	fjortz
Total	66	190.87 ± 5.87	
Rams			
Karakachan	6	199.62 ± 15.89	abcu
Tsigay	6	183.83 ± 12.89	def
Copper-red Shoumen	6	210.24 ± 4.72	dghijkl
Karnobat	6	174.15 ± 12.38	agmxy
Pleven Blackhead	6	164.96 ± 9.29	behnop
White Maritsa	6	180.50 ± 8.27	inquz
Patch-faced Maritsa	6	191.80 ± 4.48	jmorz
Stara Zagora	6	190.74 ± 7.85	kpsx
Romanov	6	159.09 ± 8.51	cflqrsy
Total	54	189.999 ± 5.85	
Female lambs			
Karakachan	6	181.63 ± 10.22	-
Tsigay	6	187.91 ± 10.59	-
Copper-red Shoumen	6	186.63 ± 13.71	-
Karnobat	6	186.69 ± 5.68	-
Pleven Blackhead	6	191.88 ± 8.07	-
Stara Zagora	6	190.16 ± 9.33	-
Romanov	6	189.10 ± 6.35	-
Total	42	186.95 ± 4.61	
Male lambs			
Karakachan	6	187.75 ± 11.78	abcp
Tsigay	6	181.45 ± 8.75	defg
Copper-red Shoumen	6	207.57 ± 4.64	adhij
Karnobat	6	147.28 ± 4.77	behkl
Pleven Blackhead	6	186.96 ± 9.30	ikmq
Stara Zagora	6	202.07 ± 7.23	flpnq
Romanov	6	151.87 ± 8.44	cgjmn
Total	42	183.59 ± 5.45	

For sheep 1, 2, 3, 4, 5, 6 $p < 0.05$
 a, b, c, d, e, f, g, h, i, j, k, l, m, n o, p, q, r, s, t, v, w, x, y, z $p < 0.01$

For rams u, x, y, z $p < 0.05$
 a, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p, q, r, s $p < 0.01$

For male lambs a, b, c, d, e, f, g, h, i, j, k, l, m, n $p < 0.01$
 p, q $p < 0.05$

Sotirov (19) has also observed breed-related differences with respect to complement activity in horses, whereas in sheep, lysozyme and complement were influence by the

temperament and productive type of animals.

In previous studies of ours, complement activity in winter was found out to be higher in Bulgarian goats from different ages and

breeds, from both genders, compared to summer activities. APCA was influenced by the age, breed and gender of animals.

In sheep, Bivolarski and Sotirov (17) observed increased activity of lysozyme in winter and higher complement concentrations in the summer. Therefore, the season had an effect on these parameters as well. Various APCA activity was reported among sheep breeds by other authors too (27, 19), as well as in horses (19) and swine (14).

As shown by our results, the breed as an independent factor, similarly to age and gender, had a significant effect on APCA activity. Their influence was considerable and statistically significant, therefore, there were big variations with regard to this element of innate resistance in studied sheep breeds. A probable cause for this is the various hereditary potential in sheep breeds for this trait.

CONCLUSIONS

The highest complement concentrations were established in Panagyurishte sheep (215.24), Maritsa White (206.87) and Copper-red Shoumen (201.15) sheep whereas the lowest – in Romanov (160.23) and Pleven Blackhead – 164.09 breeds ($p < 0.01$).

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