RELATIONSHIPS BETWEEN HEMATOLOGICAL PARAMETERS AND GLOBIN TYPES IN GENTILE DI PUGLIA OVINE BREED

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Summary
The effect of genotypes at globin systems on hematological data was evaluated on 289 Gentile di Puglia animals. A significant effect was detected for β-globin locus on hematocrit (HCT) and mean corpuscolar volume (MCV), with decreasing HCT and MCV for decreasing number of β^A alleles in the genotype. The opposite trend was observed for mean corpuscular hemoglobin concentration (MCHC). The different adaptive value of the β-globin genes is discussed.

Keywords
Sheep, globin, genetic polymorphism, hematology, Gentile di Puglia

Contribution
Seven different β-globin [1, 2, 3, 4] and four α-globin chains [5, 6, 7] have been described in domestic sheep. Moreover the presence of a quantitative polymorphism must be considered due to the fact that non allelic loci produce unequal amounts of α-globin. In sheep as in humans and most other mammals, the two α-globin genes (I α and II α) are expressed at different levels, the upstream gene being more efficient. In α-globin gene triplication and quadruplication, this trend is confirmed, i.e., the α-chain output of the downstream genes progressively decreases [8, 9]. Sheep breeds native of Apulia are highly polymorphic at the hemoglobin genetic system [10, 11]. The hematological peculiarities of Apulia native breeds seem related to the general ability to thrive in endemic tick borne disease (TBD) areas [12, 13, 14]. This work goes into the problem of blood viscosity and hemoglobin types in Gentile di Puglia ovine breed. Hematological variables (listed in table 1) were evaluated using the Cell Dyn 3700 Abbott on a total of 289 animals typed at the globin systems [15]. An analysis of variance was carried out to investigate the effect of genotypes at both globin systems on hematological data, with simultaneous adjustment for environmental factors. Genotype distribution and frequency data for both α and β systems outline the presence of almost 9 % of extranumerary haplotypes as to the α-globin genetic system and 11.7% of the β^A allele.
No significant effect was recorded for α extranumerary haplotypes on hematological data, although a decreasing trend in HCT and HBG with increasing total number of α genes per genotype was found. A significant effect was detected for β-globin locus on HCT and MCV (table 1), with decreasing HCT and MCV for decreasing number of β^A alleles in the genotype. Interestingly, the opposite trend was observed for MCHC values. This phenomenon seems related to different adaptive values of the β-globin genes, as suggested for the Leccese breed [10].

Table 1. Least-square means (LS-mean) and standard error (SE) of hematology data for β-globin genotype (β). Means with different superscripts significantly differ (P < 0.05).

		β AA (n = 6)		β AB (n = 55)		β BB (n = 228)	
Hematological variable	Code	LSM	SE	LSM	SE	LSM	SE
Red Blood Cells (x10^6/μl)	RBC	9.71	0.59	9.12	0.20	9.08	0.09
Hemoglobin (g/dl)	HGB	10.79	0.52	10.41	0.18	10.09	0.08
Hematocrit (dl/dl)	HCT	32.48[a]	1.56	30.68[a]	0.53	29.48[b]	0.25
Mean Corpuscular Volume (fl)	MCV	33.51	1.08	33.66[a]	0.37	32.38[b]	0.17
Mean Corpuscular Hemoglobin (pg)	MCH	11.11	0.41	11.48	0.14	11.19	0.06
MCH Concentration (g/l)	MCHC	33.11[a]	0.46	34.20[b]	0.15	34.53[c]	0.07

In sheep living in environments where hemotropic parasites are enzootic, β^B predominates, possibly because the low oxygen affinity of β^B allows BB sheep to tolerate anoxemic stress and to cope with parasitic anemia better than AA and AB sheep. In addition, there are evidences that a reduction of both HCT and HGB content occurs as an adaptive response to aridity, because in normal health condition low HCT values improve blood flow and oxygen exchange [10]. Lastly, and related to this aspect, higher MCHC values of BB sheep assure improvements in the availability of HGB with a consequent enhancement of the oxygen exchanges.

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