

GENETIC AND DIURNAL VARIATIONS IN THE SERUM PROTEIN PROFILE OF YEARLING CAPRINE MALES

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SUMMARY

12 GOATS comprising 4 of each of three breeds, namely West African Dwarf, Red Sokoto and crossbreds (West African Dwarf x Saanen), were bled alternately in the mornings and afternoons to evaluate their serum protein profile.

The three breeds were similar in total serum proteins but not in protein profile. The crossbred goats had more albumin than the purebreds. Alpha and beta globulins occurred in equal proportions in the West African Dwarf and crossbred goats although the latter were extremely low in gamma globulins. The results imply a higher growth rate and susceptibility to infection of the crossbred goats and suggest the need for greater husbandry care by them.

INTRODUCTION

THE reponse of different species and breeds to their environment may be determined by both genetic and immunological factors present in the blood. There is evidence that physiologic and biochemic parameters of blood are effected by diurnal rhythms (Tumbleson et al., 1972). While accepting the obvious genetic influence on the resistance of some cattle to streptothricosis in the humid tropics, Amakiri (1977) however failed to observe any relationship between serum globulin or immunoglobulin levels and resistance to infection. That notwithstanding, it is generally believed that changes in serum protein patterns are a reflection of the pathological and/or physiological state of the animal and may thus be important tools for diagnosis and prognosis despite the fact that they are not usually specific.

Apart from these factors, the nutritional state of the animal (Coles, 1967; Swenson, 1970; Dimopoulos, 1970), shock and dehydration (Coles, 1967) and high tempe-

ratures (Bond and McDowell, 1972) also affect serum protein patterns. Under high temperatures, Bond and McDowell (1972) observed an increase in serum albumin and a decrease in both alpha and beta globulins in beef cattle only after 8 days of exposure. When comparing heat — and thirst-resistant cattle and Holstein-Friesian cattle, Perk and Lobi (1959) found that while the alpha and beta globulins were similar, the albumin/globulin ratio was higher in the former breed. They therefore ascribed the heat- and thirst-resistance to the higher albumin content.

Considering the influence of the thermal conditions in the tropics and the peculiar endemic diseases, both acting singly and complementarily, we embarked on this study to: (1) provide the much needed basic data on the serum protein patterns of indigenous and crossbred (indigenous X exotic) goats and (2) evaluate the breed and diurnal effects on these patterns

MATERIALS AND METHODS

12 healthy yearling male goats weighing between 8.18 and 17.27 kg (mean — 11.94 kg) were used. They consisted of two purebreds, West African Dwarf or Fouta Djallon (WAD) and Red Sokoto or Maradi (RS) and crossbreds (WAD X Saanen) equally represented in number. The animals were sheltered at night, provided water, forage and salt licks *ad libitum* and concentrate at the rate of 0.5 kg per head per day.

Blood samples were obtained daily into non-heparinized tubes from the jugular vein using the Terumo blood

collecting system at 1000 and 1530 h on alternate basis such that two consecutive morning and afternoon collections were 48 h apart. The samples, which were collected for one week, were allowed to settle and then centrifuged at 3000 g for 10 minutes after which the serum was carefully separated with a Pastuer pipette and stored frozen until analysis. The total protein was determined by the standard Biuret method while the proteins were separated electrophoretically into the various fractions using the Elphormat (Bender and Hobein, Munich).

The data were subjected to Students' test and correlation analysis (Steel and Torrie, 1960).

RESULTS

Typical electrophoretograms are shown in Fig. 1. All the total serum proteins were unaffected by breed, the protein patterns of the three breeds were different (Table 1). The serum proteins of the crossbreds contained more albumin ($P < 0.05$) than those of the others as evidenced by the albumin/globulin ratios. In the globulins, the WAD and the crossbreds were similar in the alpha fraction and superior to the RS in the α_2^2 and B_1 fractions. The crossbreds were however poorer in gamma globulin than the purebreds. All the breeds appeared to be similar their serum pre-albumin and B_2 globulin levels.

Table 2 summarises the diurnal changes in serum protein profile as well as in the total protein. Differences were observed only in the α_2^2 and B_1 globulins. The former were more frequent in the morning ($P < 0.01$) while the latter were higher ($P < 0.01$) in the afternoon.

From the correlation analysis, the albumin/globulin ratio was not influenced by liveweight ($r = 0.05$).

DISCUSSION

As reviewed by Dimopoulos (1970), the relative constancy of the serum protein profile of a normal subject over a

considerable length of time is apparently genetically controlled. It is because of this that it is possible to differentiate species and even the strain and sex of the animal.

The present results show that although the total serum protein content was somewhat constant for a species, there were variations in the protein profile. Thus the protein content was similar to the findings of Gorczyca, McCarty and Lazaroni (1960) while the protein profiles were different. The serum proteins of the crossbred goats consisted of more albumin than those of the purebreds. By virtue of the influence of albumin on osmotic pressure, this higher albumin content implies that the crossbred goats have a higher water retaining capacity as hypothesised by Perk and Lobi (1959). It may also be a reflection of the genetic contribution of the Saanen which is exotic.

Similarly, the agreement of the alpha and beta globulin fractions in the WAD and crossbred goats reflects the genetic relationship of these animals. The higher growth rate of these crossbred (Mba, personal communication) may not be unrelated to their serum levels of albumin and alpha and beta globulins. However, they appear to be more susceptible to infections than the purebreds, a condition that is reflected by their extremely low content of gamma globulins. This relationship between resistance to infection and gamma globulin content is in consonance with the report of Perk and Lobi (1959).

The albumin and total protein were stable throughout the day unlike the globulins which showed some changes. Similar diurnal rhythms in blood physiologic and biochemic parameters have been reported (Tumbleson *et al*, 1972). That alpha globulins were higher in the mornings may imply a higher concentration of blood copper and hemoglobin as these are connected with ceruloplasmin and haptoglobulins respectively. Also the higher content of B_1 globulins in the afternoons may be a reflection of the serum iron content.

NUTRITIVE VALUE OF BROWSE PLANTS

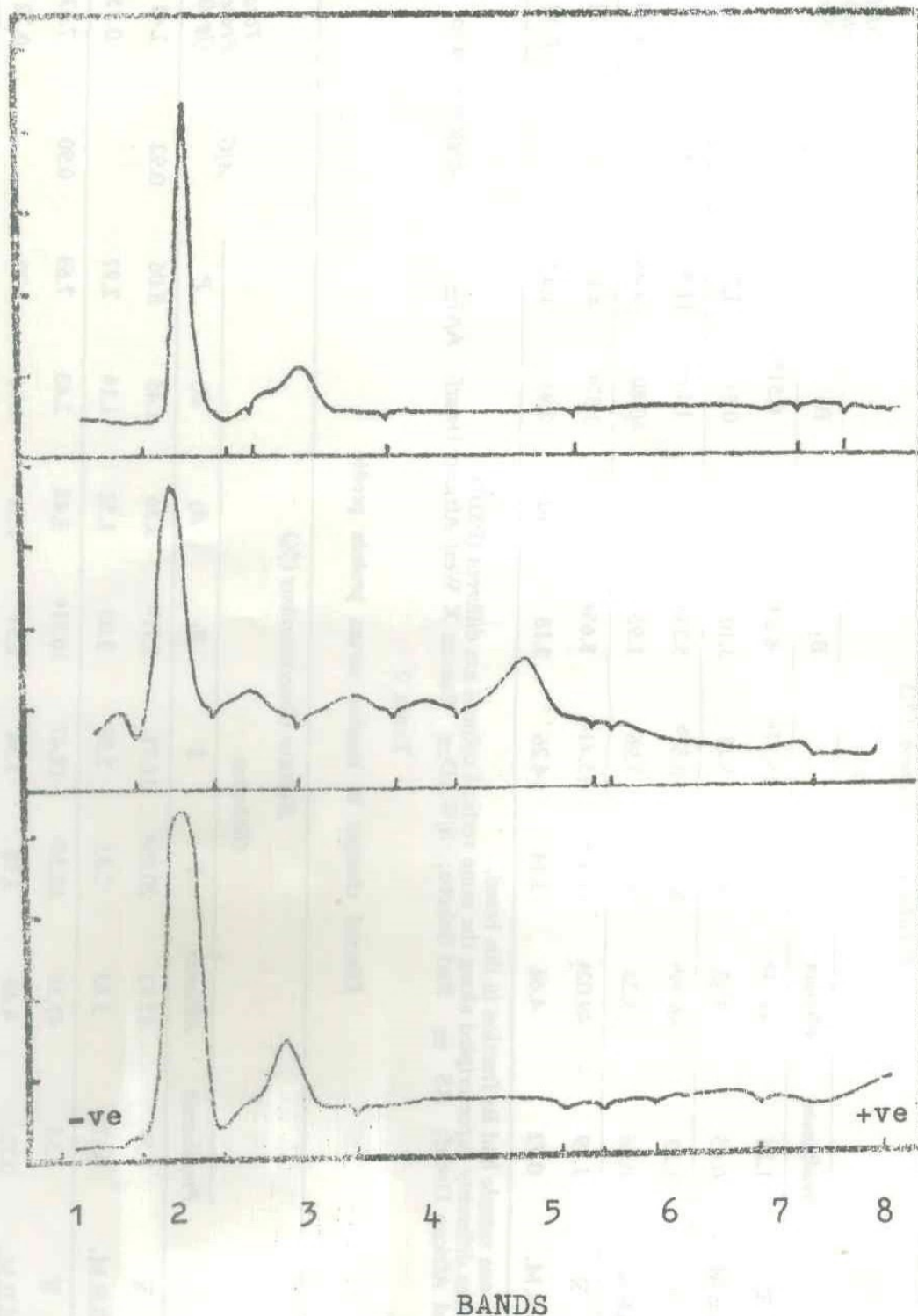


Fig .1. Electroonoretic pattern of caprine Serum Showing 8 bands moving from the point of application towards the anode.

TABLE 1
Effect of breed on caprine serum protein profile

Breed	Relative Concentrations (%)							Total Protein (g/100ml)		
	Prealbumin	Albumin	Globulins				A/G			
			1	2	B ₁	B ₂			B ₃	P
WAD	\bar{X} 1.25	46.53 ^b	17.15 ^{ab}	15.17 ^a	8.20 ^a	2.82	0.51*	8.37 ^a	0.87 ^b	7.88
	S.E.M. 0.65	4.43	4.67	3.28	3.10	1.45	0.51	3.39		0.15
RS	\bar{X} 1.23	46.39 ^b	20.28 ^a	10.87 ^b	5.23 ^b	2.85	1.17 ^b	11.98 ^a	0.87 ^b	6.57
	S.E.M. 0.96	5.28	5.24	5.96	1.95	1.51	0.80	4.44		0.24
S/WAD	\bar{X} 1.39	49.02 ^a	13.69 ^b	15.41 ^a	8.65 ^a	3.80	3.87 ^a	4.17 ^b	1.00 ^a	7.72
	S.E.M. 0.72	4.64	3.14	4.26	3.18	1.82	2.95	1.42		0.38

* Only one sample had B₃ fraction in this breed.
 Figures differently superscripted along the same vertical column are different (P<0.05).
 WAD = West African Dwarf; RS = Red Sokoto; S/WAD = Saanen X West African Dwarf; A/G = Albumin/globulin ratio.

TABLE 2
Diurnal changes in caprine serum protein profile

Time	Relative Concentrations (%)							Total Protein (g/100)		
	Prealbumin	Albumin	Globulins				A/G			
			1	2	B ₁	B ₂			B ₃	P
Morning	\bar{X} 1.59	47.83	20.09 ^a	11.71	5.71 ^b	3.56	1.45	8.06	0.92	7.41
	S.E.M. 0.61	3.43	3.83	2.86	2.03	1.52	1.14	2.97		0.35
Afternoon	\bar{X} 1.58	47.35	12.55 ^b	14.47	10.31 ^a	3.42	2.63	7.69	0.90	7.43
	S.E.M. 0.72	4.49	3.30	3.34	2.51	1.58	1.74	2.70		0.22

A/G = Albumin/globulin ratio.

Figures differently superscripted along the same vertical column are different (P<0.01).

VARIATIONS IN SERUM PROTEIN PROFILE IN CAPRINE MALES

That serum protein profile is unrelated to liveweight was demonstrated in the correlation between the albumin/globulin ratio and the liveweight. This may possibly mean that the animals had all attained the normal protein profile for the species.

Our results tend to imply that the crossbred goats are higher in growth rate and susceptibility to infection than the two purebreds and so suggest the need for greater care in the management of the crossbreds.

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