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INFLUENCE OF HAEMOGLOBIN POLYMORPHISM ON ERYTHROCYTIC VALUES IN GOATS*

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Goat as a class of animal is well adapted to an environment of high temperature and low humidity. Their adaptability to varying agro-climatic conditions of the country may be ascribed to this unique feature. The occurrence of different types of haemoglobin in goats of India is very well related to adaptability. The occurrence of various Hb variants in North Indian breeds have been reported by Joshi *et al.* (1975), Singh *et al.* (1977), Baruah and Bhat (1980), Bhat *et al.* (1983) and Panda and Patro (1987). However very little work has been carried out in the Tellicherry and other nondescript breeds of goats and hence it was considered necessary to study the haemoglobin pattern in these animals and also the influence of Hb-types upon various erythrocytic values.

Materials and methods

One hundred and twelve Tellicherry breed and forty four non-descript goats of different ages and sex were selected at random for the study. Blood samples were collected in heparinised vials and two ml. of the blood was centrifuged at 3000 rpm for 30 minutes. Repeated washings and centrifugation were carried out in order to obtain plasma free packed erythrocytes. The washed cells were suspended in distilled water so as to prepare a 3.0 g per cent solution of haemoglobin. Typing of Hb was carried out by horizontal starch gel electrophoresis using Tris - EDTA borate buffer at a pH of 8.50 (Porter *et al.*, 1964). After electrophoretic separation the gel was stained by one per cent amidoblack and destained by five per cent acetic acid. Haemoglobin types were identified. The total RBC count, Hb concentration and PCV were estimated with the heparinised blood by standard methods.

Results and discussion

The different types of Hb were identified by studying the rate of electrophoretic migration of haemoglobin bands towards anode. Foetal haemoglobin (Hb-F) was the fastest moving Hb followed by Hb-A, Hb-C and finally by Hb-B.

It was also observed that three homozygous genotypes of haemoglobin namely Hb-AA, Hb-BB and Hb-CC exist in the Tellicherry breed and two genotypes namely homozygous Hb-AA and heterozygous Hb-AB exist in the non-descript goats. In both Tellicherry and non-descript goats the gene frequency of Hb^A was found to be higher (0.94) compared to other genes like Hb^B and Hb^C (Table 1). High incidence of Hb^A in other Indian breeds of goats has been reported by Joshi *et al* . (1975), Goel and Nair (1976), Singh *et al.*, (1977), Baruah and Bhat (1980), Bhat *et al.* (1983), Shamsuddin *et al.* (1986) and Panda and Patro (1987). The high incidence of Hb-A in India may be due to its better adaptability of Indian climatic conditions.

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Table 1 Genotype and gene frequencies of Hb types of goats

Breed	Total No. of animals	Genotype frequency				Gene frequency		
		Hb-A	Hb-AB	Hb-B	Hb-C	Hb^A	Hb^B	Hb^C
Tellicherry	112	0.946 (106)	--	0.09	0.045	0.946	0.09	0.005
Non-descript	44	0.886 (39)	0.114 (5)	--	--	0.943	0.057	-

Values in parentheses indicate the number of animals

Table 2 Erythrocytic values of adult Tellicherry goats in relation to haemoglobin types

Hb-types	No. of animals	Hb (g/dl)	RBC($X10^6/mm^3$)	PCV (%)
Hb-A	56	$9.87^a \pm 0.14$	$14.13^a \pm 0.14$	$27.39^a \pm 0.40$
Hb-B	1	10.11^a	14.21^a	27.00^a
Hb-C	2	$9.87^a \pm 0.35$	$13.69^a \pm 0.22$	$29.00^a \pm 0.71$

Table 3 Erythrocytic values of non-descript goats in relation to haemoglobin types

Hb-types	No. of animals	Hb (g/dl)	RBC($X10^6/mm^3$)	PCV (%)
Hb-A	39	$9.07^a \pm 0.16$	$13.72^a \pm 0.19$	$24.82^a \pm 0.50$
Hb-AB	5	$10.26^b \pm 0.20$	$15.15^b \pm 0.212$	$28.60^b \pm 0.83$

Means having different superscripts differ significantly ($P< 0.01$)

All the kids revealed the presence of Hb-F during early phase of life. In the present investigation it was observed that the complete replacement of Hb-F by adult haemoglobin occurred by about 42 days of age as reported by Panda and Patro (1987). Hb-F possesses higher affinity for oxygen and this property is advantageous during the intrauterine life for proper oxygenation of the foetal tissue, whereas during extra uterine life Hb-F delivers reduced amount of oxygen for a given concentration of haemoglobin and therefore needs a change over to adult haemoglobin.

A band for an intermediary type of haemoglobin was seen located in a position between Hb-A and Hb-B which was identified and named as Hb-C. This may be similar to Hb-C noticed in bovines. Boyer (1967) and Blunt *et al.* (1969) reported that Hb-C was produced in goats as a result of anaemia by the complete replacement of beta chains of Hb-A by beta chains of Hb-C and Hb-C was seen in the circulating blood for longer periods in goats even after recovery from anaemia. This suggested that Hb-C observed may possibly be due to onset of anaemia at an earlier period of life.

No significant difference was noticed in the values of total RBC count, PCV and Hb concentration between Tellicherry goats belonging to haemoglobin types A. B and C (Table-2).

But in non-descript goats with heterozygous genotypes (Hb-AB) significantly higher values were recorded for Hb level, RBC count and PCV compared to goats with homozygous genotype (Table 3). Antova and MKrtchyan (1977) and Bhuvanendran *et al.* (1981) observed that heterozygous animals possessed better economic traits like higher body weight and low helminth egg count than homozygous animals.

Summary

High incidence of Hb-A was observed in Tellicherry and non-descript goats. Haemoglobin types like A, B and C were observed and all of them were genetically homozygous in Tellicherry breed, whereas in non-descript goats heterozygous haemoglobin type (Hb-AB) was observed. Erythrocytic values of heterozygous goats were predominant over homozygous goats. Haemoglobin F showed fastest anodal mobility followed by type A, C and B.

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