

ERYTHROCYTE GLUTATHIONE LEVEL IN RELATION TO HAEMOGLOBIN TYPE IN RAJASTHAN DESERT SHEEP*

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Abstract

Concentrations of reduced glutathione (GSH) in erythrocytes were determined in 344 adult ewes of four sheep breeds (Marwari, Chokla, Jaisalmeri, and Magra) indigenous to the Rajasthan desert, India. Comparisons were made between the numbers of high GSH (GSH^H) and low GSH (GSH^h) type animals and between the numbers of GSH^H and GSH^h animals of A, AB, and B haemoglobin type. In all, 77% Jaisalmeri, 75% Chokla, 67% Marwari, and 52% Magra animals were GSH^h type. Chokla animals of both GSH types had the lowest mean erythrocyte GSH levels of all breeds tested. No effect of haemoglobin type on erythrocyte GSH level was apparent in the tested sheep of either GSH type.

Reduced glutathione (GSH) in red blood cells has been ascribed a variety of important functions (Jaffe 1970). Several reports (Smith and Osburn 1967; Tucker and Kilgour 1970, 1972; Agar and Roberts 1971; Kalla *et al.* 1972) suggest a bimodal distribution of erythrocyte GSH levels in sheep. Tucker and Kilgour (1970) have classified sheep as high GSH (GSH^H) and low GSH (GSH^h) type on the basis of the concentration of GSH in the red blood cells. These workers have also shown that, in the Finnish Landrace sheep, these two types are inherited in a Mendelian manner, GSH^H being dominant over GSH^h . In the cross-bred Tasmanian Merino, however, dominance of GSH^h over GSH^H has recently been reported (Tucker and Kilgour 1972).

Interest in the measurement of GSH levels in the erythrocytes of domestic animals has been increased due to the possible relationships between erythrocyte GSH level and growth rate, body size, and fleece weight (Kidwell *et al.* 1955; Charkey *et al.* 1965; Agar *et al.* 1972b).

Agar and Roberts (1971) and Agar *et al.* (1972a) have observed an association between haemoglobin (Hb) type and erythrocyte GSH level in GSH^H sheep. The Hb B animals used by these workers had significantly lower GSH levels than the Hb AB animals at all ages. Hb A and GSH^h animals were not included in that study. The present note presents the results of a study of the erythrocyte GSH levels in Hb A, AB, and B sheep of four breeds indigenous to the Rajasthan desert, India.

Materials and Methods

A total of 344 adult ewes of the Marwari, Chokla, Jaisalmeri, and Magra breeds, derived from this Institute's flocks, were used in the study. About 5 ml blood was obtained by jugular

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venipuncture and collected into heparinized vials. GSH levels in whole blood were determined by the 5-dithiobis(2-nitrobenzoic acid) method of Beutler *et al.* (1963) within 6 hr after collection. The concentration of GSH per 100 ml of packed red cells was calculated from the whole blood haematocrit values. Sheep with GSH values below 55 mg/100 ml red blood cells have been classified as GSH^h, while those with values of 55 mg/100 ml red blood cells or more have been classified as GSH^H (Tucker and Kilgour 1970). Haemoglobin types were determined by horizontal starch gel electrophoresis using a continuous buffer system (Gahne *et al.* 1960).

Results and Discussion

Table 1 shows the mean erythrocyte GSH concentrations in GSH^H and GSH^h sheep of the four different breeds. GSH^h animals were found to predominate in the Marwari, Chokla, and Jaisalmeri breeds, while in the Magra breed the two types

TABLE 1
GSH LEVELS IN THE ERYTHROCYTES OF DIFFERENT BREEDS OF SHEEP
GSH values are given as milligrams per 100 ml red blood cells

Breed	GSH ^H		GSH ^h	
	No. of animals	Mean \pm S.E.M.	No. of animals	Mean \pm S.E.M.
Marwari	53	73.66 \pm 2.70	106	39.39 \pm 3.27
Chokla	18	64.31 \pm 2.29	54	33.46 \pm 1.04
Jaisalmeri	13	67.60 \pm 2.91	44	43.08 \pm 1.13
Magra	27	74.75 \pm 3.70	29	40.20 \pm 2.48

TABLE 2
ERYTHROCYTE GSH LEVELS WITHIN HAEMOGLOBIN TYPES IN FOUR BREEDS OF SHEEP
GSH values are given as milligrams per 100 ml red blood cells

Breed	Haemoglobin type	GSH ^H		GSH ^h	
		No. of animals	Mean \pm S.E.M.	No. of animals	Mean \pm S.E.M.
Marwari	A	2	78.42 \pm 6.56	10	42.38 \pm 3.70
	AB	15	73.62 \pm 3.99	26	39.45 \pm 1.89
	B	36	73.43 \pm 3.29	70	38.95 \pm 4.89
Chokla	A	2	78.25 \pm 17.75	7	37.90 \pm 4.88
	AB	5	62.23 \pm 1.47	21	43.83 \pm 1.25
	B	11	62.72 \pm 2.12	26	38.26 \pm 1.41
Jaisalmeri	A	3	65.84 \pm 5.46	4	48.13 \pm 6.06
	AB	5	71.80 \pm 6.04	15	44.09 \pm 1.88
	B	5	64.47 \pm 3.65	25	41.67 \pm 3.73
Magra	A	6	66.74 \pm 2.70	1	47.86
	AB	5	84.38 \pm 14.22	10	39.43 \pm 3.47
	B	16	74.75 \pm 4.35	18	40.21 \pm 3.37

were almost evenly distributed. In all, 75% Chokla, 77% Jaisalmeri, and 67% Marwari animals were GSH^h type. Both GSH^H and GSH^h Chokla animals had the lowest mean erythrocyte GSH levels of all breeds tested. Agar *et al.* (1972b) failed to locate

any GSH^h animal in their samples of Dorset Horn, Poll Dorset, and Border Leicester breeds while they had only one animal of this type out of the 23 Corriedale sheep included in their study. In contrast, about 22% of the Merinos examined by Agar *et al.* (1972*b*) were GSH^h type. Evidently, erythrocyte GSH dimorphism is a more common feature of the Rajasthan desert breeds.

Table 2 shows erythrocyte GSH levels in high and low GSH type animals belonging to different haemoglobin types. The means for the three haemoglobin phenotypes within each breed and within each GSH type were compared by applying Student's *t*-test, which revealed no significant difference between any two haemoglobin types in any of the breeds. Hence, haemoglobin type does not seem to have any effect on erythrocyte GSH level in sheep of either of the GSH types in the four breeds examined by us. Our findings do not, therefore, agree with the observations made by Agar and Roberts (1971) and Agar *et al.* (1972*a*). Obviously, considerable breed differences exist in this respect.

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