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Communication

Erythrocyte glutathione concentrations in Nigerian Zebu and Ndama cattle

I.O. Igbokwe[1*]

I.A. Umar[2]

O.K. Obagaiye[2]

D.I. Saror[1]

K.A.N. Esievo[1]

A study of the erythrocyte glutathione (GSH) concentrations in Nigerian Zebu and Ndama cattle gave a range of 40.8-135.1 mg/100 ml RBC with a mean of 84.0 ± 25.4 mg/100 ml. The GSH concentrations and the packed cell volume (PCV) of the cattle were positively correlated (r = 0.58, p < 0.05). The Ndama had significantly (p < 0.05) higher mean erythrocyte GSH and PCV levels than the Zebu. At comparable PCV levels, the erythrocyte GSH did not vary significantly (P > 0.05) between breeds.

Key words : Ndama cattle - Zebu cattle - Erythrocyte - Nigeria.

Introduction

Gluthatione (L-glutamyl-cysteinyl-glycine, GSH) is the only important antioxidant non-protein sulfhydryl compound in erythrocytes (5). It reacts with endogenous hydrogen peroxide and lipid hydroperoxides in the presence of GSH peroxidase to protect the erythrocyte from oxidative damage (14). The animals reported to have low erythrocyte GSH show no evidence of anaemia (1) and no significant haemolysis is detected after the administration of oxidizing drugs (13). However, erythrocyte GSH concentration decreases under oxidative stress caused by copper poisoning in sheep (19) and hypophosphataemia in post-parturient haemoglobinuria of buffaloes (15, 16, 17). Erythrocyte GSH level has also been related to productivity charateristics such as growth rate, body weight and milk yield (1, 11). The normal erythrocyte GSH concentrations in apparently healthy Nigerian Zebu and Ndama cattle and the relationship to packed cell volume (PCV) are presented in this study to provide reference data for future research.

1. Department of Veterinary Pathology and Microbiology, Ahmadu Bello University, Zaria, Nigeria.

2. Department of Biochemistry, Ahmadu Bello University, Zaria, Nigeria.

* Adresse actuelle : Department of Veterinary Pathology, Faculty of Veterinary Medicine, PMB 1069, Maiduguri, Nigeria.

Materials and Methods

Thirty-nine apparently healthy Ndama (n = 9) and Zebu (n = 30) cattle of both sexes, aged 1-5 years and weighing 70-300 kg, were used. The animals were located at Samaru and Shika in Zaria Province respectively, where they were grazed daily, but only the Ndama received supplemental feeding which consisted of grain offals, cotton seeds and palm kernel cakes. Water, and sometimes salt licks, were freely available.

A blood sample (5 ml) was collected from each animal by jugular venipuncture and placed in a container with EDTA as an anticoagulant. The Zebu were bled once, but the Ndama were bled twice at one week's interval. The packed cell volume (PCV) was determined by the microhaematocrit method. The GSH determination was carried out on whole blood according to the method of Beutler *et al.* (5) and erythrocyte GSH concentration was calculated from the PCV (6).

The data were summarized as means ± standard deviations, analysed using paired Student's t-test, and correlation and regression statistics were computed between erythrocyte GSH concentrations and PCV (7).

Results

The mean PCV, whole blood and erythrocyte GSH concentrations in Nigerian Zebu and Ndama cattle, presented in table I, show that the Ndama had significantly (p < 0.05) higher values than the Zebu. The erythrocyte GSH concentrations in both breeds ranged from 40.8 to 135.1 mg/100 ml RBC (40.8 - 127.3 and 70.6 - 135.1 mg/100 ml RBC in Zebu and Ndama respectively).

There was a significant (p < 0.05) positive correlation (r = 0.58) between the erythrocyte GSH and PCV of all the animals (fig. 1). The regression equation was given as GSH = 11.8 + 2.6 (PCV). At the PCV range of 27-30 %, the mean PCV and erythrocyte GSH concentrations of both breeds were not significantly (p > 0.05) different. The mean PCV values were 28.7 ± 1.2 % (n = 6) and

TABLE I
Packed cell volume, blood and erythrocyte glutathione concentrations in Nigerian cattle

	PCV (%)	Whole blood GSH (mg/dl)	Erythrocyte GSH (mg/100 ml RBC)
Zebu (n = 30)	24.7 ± 4.1[a]	18.4 ± 7.4[a]	73.4 ± 23.5[a]
N'Dama (n = 9*)	33.1 ± 4.2[b]	34.3 ± 8.6[b]	102.6 ± 16.8[b]
All cattle	27.8 ± 5.8	24.2 ± 10.9	84.0 ± 25.4

[a, b] Values with different supercripts are significantly different (p < 0.05).
n : Number of animals.
* Sampled twice ; mean based on 18 samples.

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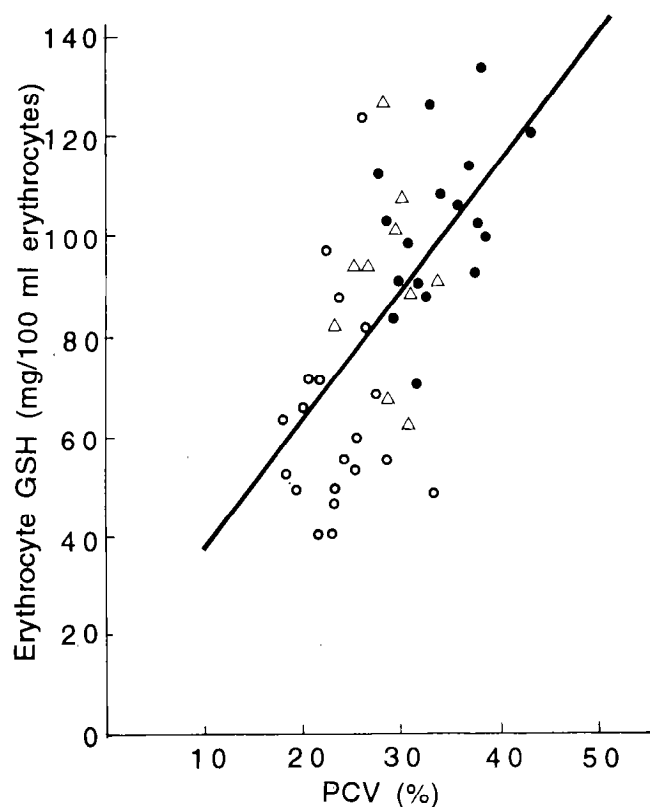*Figure 1: The relationship between erythrocyte glutathione concentrations and packed cell volume of adult (△) and young (o) Zebu and Ndama (•) cattle.*

28.4 ± 1.1 % (n = 5) and the mean erythrocyte GSH concentrations were 93.3 ± 24.8 and 97.7 ± 11.0 mg/100 ml RBC for Zebu and Ndama respectively.

Discussion

The erythrocyte GSH concentrations in Nigerian Ndama and Zebu gave a similar range as previously reported (40-113 mg/100 ml RBC) in some breeds of cattle (2), but with a higher upper limit. Although the Ndama had a higher erythrocyte GSH concentration than the Zebu, this was not considered as a breed difference. When the PCV values of the Zebu and Ndama were comparable, there was no difference in the erythrocyte GSH concentrations between the breeds. This agrees with the earlier report of Board et al. (6) which did not indicate any variations due to this factor.

The relationship beween erythrocyte GSH concentrations and PCV in cattle has not been previously descri- bed (2). The present study shows that erythrocyte GSH concentrations and PCV in Nigerian Ndama and Zebu cattle were positively correlated. Therefore, the Ndama

that had higher erythrocyte GSH also had higher PCV values than the Zebu. This is in agreement with the report of Agar et al. (3) that sheep with high erythrocyte GSH had higher PCV levels than sheep with low erythrocyte GSH. However, this contrasts with the report in man that an inverse relationship existed between the erythrocyte GSH level and PCV (10). It appears that the inverse rela- tionship may only exist in animals during regenerative anaemic conditions. At this time, erythrocyte GSH concentrations usually increase (4, 12, 20) due to the cir- culating young erythrocytes which have higher GSH concentrations and greater GSH metabolizing enzyme activity than older erytrocytes (4, 8, 10, 20).

The factors responsible for the wide range of values for the erythrocyte GSH levels (2) and the direct relationship with PCV are yet to be identified, but nutrition may be relevant since the erythrocyte concentrations of sub- strates for GSH synthesis such as glutamate, glycine and adenosine triphosphate have been considered important in regulating erythrocyte GSH level (18). The mean whole blood GSH was reported to be higher (25.1 mg/dl) in catt- le in good condition than the emaciated ones (16.9 mg/dl) (9). Therefore, the Ndama may have higher blood and erythrocyte GSH concentrations and PCV values becau- se they were on a better nutritional regimen than the Zebu. Variations in the activities of erythrocyte GSH metabolizing enzymes may not have affected the erythro- cyte GSH concentrations because it has been reported that the activities of these enzymes did not differ signifi- cantly in cattle with high (102 mg/ 100 ml) and low (56 mg/100 ml) erythrocyte GSH concentrations (2).

Conclusion

The erythrocyte GSH concentrations of Nigerian Ndama and Zebu cattle were positively correlated to their PCV values. The higher erythrocyte GSH associated with higher PCV in Ndama might be related to their better nutritional regimen.

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IGBOKWE (I.O.), UMAR (I.A.), OBAGAIYE (O.K.), SAROR (D.I.), ESIEVO (K.A.N.). Concentrations du glutathion érythrocytaire des bovins zébus et Ndama nigérians. *Revue Elev. Méd. vét. Pays trop.*, 1995, 48 (2) : 177-179

Une étude réalisée sur les concentrations de glutathion érythrocytaire des bovins zébus et Ndama nigérians a mis en évidence une variation allant de 40,8 à 135,1 mg/100 ml de globules rouges, avec une moyenne de 84,0 ± 25,4 mg/100 ml. On a observé une corrélation positive entre les concentrations de glutathion et l'hématocrite (r = 0,58, p<0,05). Les valeurs moyennes de glutathion érythrocytaire et de l'hématocrite obtenues chez les bovins Ndama se sont révélées significativement (p<0,05) plus élevées que celles enregistrées pour les zébus. A des valeurs d'hématocrite comparables, les concentrations de glutathion érythrocytaire n'ont pas varié de façon significative entre les races (p>0,05).

Mots clés : Bovin Ndama - Zébu - Erythrocyte - Nigeria.