Trakia Journal of Sciences, Vol. 3, No.6 , pp 8-10, 2005

Available online at:
http://www.uni-sz.bg

ISSN 1312-1723

Original Contribution

A STUDY OF THE DISTRIBUTION OF POTASSIUM POLYMORPHISM IN ERYTHROCYTES OF GREY CATTLE RAISED IN THE EDIRNE PROVINCE OF TURKIYE

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ABSTRACT

The genetic constitution of population with respect to potassium concentration locus was examined. The distribution of red-cell potassium was studied in Grey Steppe breed of cattle. Two classes of cattle were identified, one with potassium concentrations higher than 46 m-equiv/l (HK), and another with lower concentrations (LK). Blood potassium and sodium concentration of Grey Cattle in 39 animals comprising 10 bulls and 29 cows, with different ages, were studied. Mean (K_e) values for (LK) and (HK) animal were 29,50 ± 7,26 m-equiv/l, and 53,28 ± 9,23 m-equiv/l respectively. The (K^h) and (K^l) allele frequencies were 0,22 and 0,78, respectively.

Key words: red cell potassium polymorphism, grey cattle; potassium and sodium concentration

INTRODUCTION

The main function of potassium is to regulate the intracellular density of cells (Mert et al, 1986). Ellery and Tucker (1970) have drawn attention to the similarity of inheritance model of cattle blood potassium concentration with that of the sheep. They proposed that the (LK) gene was dominant over the (HK) gene. Rasmussen et al, (1974) suggested that potassium concentration of red cells in cattle could be controlled by two co-dominant alleles.

There were some studies showing the polymorphic nature of blood potassium concentration of buffaloes (Pandey and Roy, 1968), (Soysal et al, 2005), goats (Soysal, and Ülkü, 1998), and cattle (Evans and Philipson, 1957), (Howest et al, 1963), (Evans, 1963), (Gonzales and Vallejo, 1983), (Gonzales et al., 1988a, 1988b), (Gonzales and Tunon, 1987), (Soysal and Gürcan, 2002) and studies of blood (K) concentration of cattle breed.

MATERIAL AND METHODS

Blood samples were taken from a total 29 female and 10 male animals from different age groups and belonging to the Grey Steppe cattle breeds of Hisarlı village of Edirne. In this study 10 cc blood samples were taken from the external jugular vein using lithium heparin vacuum tube with bleeding needle. Haematocrit value (packed cell volume, PCV) was determined by the micro haematocrit method. Concentrations of (K^+) in whole blood (K_{wb}) and plasma (K_p) were estimated by flame photometer in 1:200 diluted samples using the procedures explained by Evans (1954). Red cell (K^+) concentration (K_e) was calculated indirectly by means of the following formula as m-equiv/l.

$K_e=[K_p + [(K_{wb} – K_p) / (pcv / 100)]$

Sodium concentrations of the plasma (Na_p) and whole blood (Na_{wb}) were also measured photometrically. The (LK) allele frequencies were obtained from the square root of the percentage of (HK) phenotype animals. The data were grouped according to age, sex and (K) concentration types. Statistical analysis was done using completely randomized experimental design. Cattle with potassium concentration higher than 46 m-equiv/l were identified as High Kalium types HK. The cattle with lower than 46 m-equiv/l were identified as Low Kalium types (LK) (Gonzales et al, 1988a). The relationship

between potassium and sodium concentrations was also investigated and tabulated as correlation matrices.

RESULTS AND DISCUSSION

Two different red cell (K) concentration types, low kalium (LK) and high kalium (HK), were determined. The (K^h) and (K^l) allele frequencies were 0,22 and 0,78, respectively. Gonzales and Vallejo (1983) found the same allele frequencies as 0,32 and 0,68 respectively for the Sayaquesa breed, Gonzales et al, (1987) found the same allele frequencies as 0,22 and 0,78, respectively, for the Alistera Sonobresa breed.

***Table 1**: The distribution of K_e. allele frequencies according to the breeds*

Breeds	*Allele*	*Frequency*
Black and White (Soysal et al, 2002)	K^H	0.92
	K^L	0.08
Morucha (Gonzales et al, 1987)	K^H	0.17
	K^L	0.83
Blanca Cocerona (Gonzales et al, 1987)	K^H	0.00
	K^L	1,00
Cordena Andokza (Gonzales et al, 1987)	K^H	0.20
	K^L	0,80

***Table 2:** The average haematocrit value, potassium (Kalium) and sodium concentrations of HK and LK types*

Genotype	K_e *(m-equiv/l)*	K_p *(m-equiv/l)*	K_{wb} *(m-equiv/l)*	Na_p *(m-equiv/l)*	Na_{wb} *(m-equiv/l)*	*HV*	*Total*
HK	53,2±9,23	8,28±2,81	23,0±5,75	170,3±4,93	163,0±2,53	34,0±5,65	2
LK	29,5±7,26	7,07±0,02	15,5±2,27	174,5±20,8	163,0±11,9	34,6±3,66	37

The abbreviations of
K_e, K_p, K_{wb} are for (K) concentration (m-equiv/l) of erythrocyte, plasma and whole blood respectively.
Na_p, Na_{wb}, are for (Na) concentration (m-equiv/l) of erythrocyte, plasma and whole blood respectively.
HV: Haematocrit values.

Mean (K_e) values for (LK) and (HK) animals were 29,50 ± 7,26 m-equiv/l, and HK 53,28 ± 9,23 m-equiv/l, respectively. The differences between the mean K_e values in (HK) and (LK) groups were important ($p<0,01$).The mean differences in (K_e) concentrations between (HK) and (LK) groups, regarding K_{wb}, were also significant ($p<0,01$). The mean whole blood potassium concentrations were 15,53 ± 2,27 and 23,04 ± 5,75 for (LK) and (HK) types respectively. The mean haematocrit value differences between (HK) and (LK) groups were not significant. The plasma (Na) and whole blood (Na) concentration differences between (HK) and (LK) groups were not significant. The differences among K_e, K_p, K_{wb}, Na_p, Na_{wb}, HV values of age groups were not significant. The differences among K_e, K_p, K_{wb}, Na_p, Na_{wb}, HV values according to the sex were not significant. The highest coefficient of relationship obtained for the $K_e - K_{wb}$ was 0,765.

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