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Inheritance of intra-erythrocytic potassium level variations in guinea fowl

S.K. PAL AND HARPREET SINGH

Central Avian Research Institute,
Izatnagar - 243 122 (U.P)

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ABSTRACT

Erythrocytic potassium level revealed wide individual variations; mean values for male and female growers (12 wks age) were 87.9±1.6 and 89.7±1.2 meq/litre respectively. Differences between sex and varieties were not significant. Inheritance studies revealed medium heritabililty estimates (0.470±0.229); associations with body weights showed positive trends.

Contains 2 tables and 1 fig.

Key words : Erythrocyte, potassium, inheritance, guinea fowl

Existence of wide ranging variations for blood potassium level were reported for domestic fowl and other avian species (Balash *et al.*, 1973; Oyewale *et al.*, 1989). Shablina (1978) observed simple mendelian inheritance for erythrocytic potassium level in chicken. Low to medium heritability estimates and significant associations with economic traits were also described for these traits (Mangle *et al.*, 1979; Singh *et al.*, 1984, 1989). This article presents preliminary information on genetic and nongenetic factors which influence erythrocytic potassium levels in guinea fowl.

Investigations included 274 'Guncari' growers (12 wk) belonging to 12 sire families of Lavender, Pearl and White varieties. Quantitative estimation of potassium contents in red cells was done as per the method of Eagleton *et al.* (1970). Effect of sire and sex on red cell potassium level was obtained on hatch corrected data as per Harvey (1975); a linear statistical model was followed for estimation of the heritability values. Duncan's Multiple Range test was used for pair-wise comparison of the group means.

Intra erythrocytic potassium levels showed wide ranging individual variations (Table 1). The mean erythrocytic potassium levels observed for male and female birds : 87.9±1.6, 89.7±1.2 meq/l (range 65.2 – 120.9 meq/litre) respectively are within the broad range for avians and similar to the values reported for chicken and turkey (97.2, 99.5 mM/kg) (Kerr, 1937; loc. cit. Swenson, 1984) but are much lower than the erythrocytic potassium levels (range 210-490 meq/litre) reported by Shablina (1978). But potassium level in blood plasma (male 5.2±0.6, female 3.1±10.5 meq/litre) showed good agreement with the values reported for guinea fowl (Balash

Table 1 : Mean erythrocytic potassium levels (meq/l) observed in guinea fowl growers (12 wk)

Plumage type	n	Potassium level	Feathering type	n	Potassium level
White	94	97.0±2.3	slow	138	86.6±1.8
Lavender	78	88.3±2.6	Fast	136	87.20±0.0
Pearl	102	85.5±2.3	—	—	—
Mean value	274	86.9±2.4	—	274	86.9±1.4

et al., 1973; Oyewale *et al.*, 1989) and domestic fowl (Mangle *et al.*, 1979; Singh *et al.*, 1984, 1989). Shablina (1978) reported predominance of high potassium type among the investigated domestic fowl populations, but no such distribution trend was detected for the arbitrarily identified high, low and medium levels in the three guinea fowl varieties (Table 2). Although potassium level differences between sex and between varieties were not significant; but sire × variety interactions were highly significant. The trimodal frequency distribution pattern (Fig. 1) and observation of moderate heritability estimate (h^2 0.470±0.229, value 17.5) in 'Guncari' guinea fowl population suggest existence of significant genetic influences in determination of red cell potassium levels as reported for chicken by Shablina (1978). Results of association studies with potassium level showed a trend of positive phenotypic and genetic correlations with body weights at hatch, 4 wk and 12 wk age : r 0.2, 0.10, 0.12; r_g 0.35±0.33, 0.11±0.43,

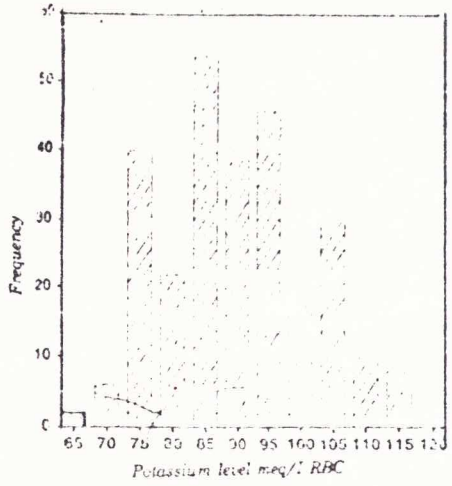

Fig. 1 : Distribution of red cell potassium levels in GUNCARI population at 12 weeks

Table 2 : Percent distribution of red blood cell potassium level (meq/l) in guineafowl (12 wk)

Variety	n	High (<105)	Medium (105-80)	Low (>80)
White	94	24.6	60.6	14.8
Lavender	78	24.3	64.2	11.5
Pearl	102	27.6	50.1	22.5
Overall	274	25.5	57.6	16.9

0.41±0.5 respectively. These observations are also in good agreement with reports for plasma potassium level in chicken (Singh *et al.*, 1984, 1989).

In domestic fowl single gene mendelian inheritance for intra-erythrocytic potassium levels was reported by Shablina (1978) and in case of sheep incomplete dominance was observed. Erythrocytic potassium variations were also attributed to interactions between genotype, breed and sex (Eagleton *et al.*, 1970). It was further observed that these genes also influence the number and activity of Na^+ K^+ ATPase pumps which determine the intra cellular potassium level and its transportation into serum. Potassium ions (K^+) perform vital role in diversified living cell activities particularly the osmoregulatory functions. Observations of significantly lower erythrocytic potassium values in guiea fowl vis-a-vis chicken indicate the need to confirm the differences between species with more detailed investigations before definite conclusions are drawn.

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