TRANSFERRIN POLYMORPHISMS AND GROWTH RATE IN RHODE ISLAND RED, CROSSBRED AND NATIVE CHICKENS

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Summary

Transferrin polymorphisms and growth rate up to 12 weeks of age were observed in RIR, crossbreds and native chickens. Tf^{BB} genotype was observed in all types of bird. Tf^{BC} occurred only in crossbred and native chickens. Frequency of Tf^{B} was the highest in all types. Mean body weights at 8- and 12- weeks of age were the highest in RIR (292 $\pm$ 37.77 and 612 $\pm$ 75.69 g respectively) and the lowest in natives for Tf^{BC} (180 $\pm$ 11.54 and 308 $\pm$ 4.94 g respectively). The difference in 12 week body weight of crossbreds between Tf^{BB} and Tf^{BC} was found to be significant ($p < 0.05$). The results indicate that crossbreds (Tf^{BB}) may be grown effectively upto 12 weeks of age under Bangladesh conditions.

(Key Words: Transferrin Polymorphisms, Genotypes, Growth Rate, Chickens)

Introduction

Poultry plays very important role in supplying meat and egg to meet up the protein requirement of Bangladesh. It has been manifested by manifold increase in demand during the recent past. But, unfortunately, the indigenous birds of Bangladesh are poor producer of both meat and egg. For example, Bangladeshi hens produce only 36 small size eggs per bird per year (Hoque and Ali, 1975). They are, however, highly adaptable to Bangladesh environment and more resistant to local diseases compared to exotic types. It is primarily due to their poor genetic make-up. The genetic improvement of indigenous poultry in Bangladesh is, therefore, very essential. Before undertaking any improvement programme with indigenous birds, it is important to know their genetic make-up or genotypes.

It has also been observed that crossbreeding indigenous birds with exotic breeds is getting popularity in Bangladesh. It is, therefore, imperative to know the genetic make-up of the crossbred birds as well as their difference with exotic and indigenous chickens.

Keeping in view the above facts, the present experiment was conducted to: (i) Study the genetic constitution with respect to transferrin polymorphisms of Rhode Island Red (RIR), Native, and their crossbreds, and (ii) to find out the relationship between transferrin types and growth performance of different types of birds.

Materials and Methods

The experiment was conducted in the poultry farm and in the Animal Genetics laboratory of Bangladesh Agricultural University, Mymensingh, Bangladesh. Sixty RIR, 60 crossbred and 150 native day-old chicks were randomly sampled from large batches and were wingbanded. Standard feeding, health care and management were ensured for all types of birds. The birds were weighed at weekly interval from day-old to 8 weeks of age. Female birds were then separated from male birds. There were altogether 112 female birds of which 24 were RIR, 26 crossbred and 62 natives. Body weight of these birds were recorded at 12th week of age.

About 2 ml blood was collected from the veins of the birds aging 8-weeks or more with the help of sterilized needles in test tubes coated inside with layers of petroleum jelly. After each collection, the test tubes were kept at room temperature for 1 hr to clot the blood and were then

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preserved in the refrigerator at 5℃ for 4-6 hrs. The sera were separated from the cells by centrifuging the samples at 2200 rpm for 7, 5 and 2 minutes respectively. The sera contained in the tubes, were preserved at −20℃ until electrophoresis was done.

Transferrin locus was examined by starch-gel electrophoresis method outlined by Stratil (1968). Amino Black 10B and Nigrosine stain were used for detecting transferrin types. The transferrin (Tf) were located as two staining bands midway between α- and β- globulin regions. Two dark bands were identified as Tf^{BB} representing BB genotypes. The one darken and the other faintly band was identified as Tf^{BC} representing BC genotypes.

Frequency of Tf^B and Tf^C genes were calculated using the following formula (Falconer, 1989):

$$p = p + \tfrac{1}{2}H$$
$$q = 1 - p$$

where p = frequency of B gene, q = frequency of C gene, P = proportion of homozygote, Q = proportion of heterozygote.

Recorded data on body weight at day old, at 8 and 12 weeks of ages were analysed after Steel and Torrie (1981) using completely randomized design. The statistical model was:

$$Y_{ij} = \mu + \alpha_i + e_{ij}$$

where μ = overall mean,
α_i = effect of ith transferrin type,
e_{ij} = error term.

Results

Two transferrin genotypes were observed in the blood sera examined. The homozygote (Tf^{BB}) and heterozygote (Tf^{BC}) genotypes are shown in figure 1. The distribution and frequency of Tf^B and Tf^C gene are represented in table 1.

The type of birds, corresponding transferrin genotypes and their growth performance at 8- and 12- weeks of age are presented in table 2.

Duncan's New Multiple Range Test, done to see which mean was significantly different from others, has been presented in table 3.

TABLE 1. DISTRIBUTION OF TRANSFERRIN GENOTYPES AND THEIR GENE FREQUENCY IN RIR, CROSSBRED AND NATIVE BIRDS

Breed/Strain	No. of chicks	Transferrin genotypes	Gene frequency	
			Tf^B	Tf^C
RIR	24	BB (24)[a]	1.000	0.000
Crossbred	26	BB (20) BC (6)	.885	.115
Native	62	BB (35) BC (27)	.783	.217

( )[a] = Number of chicks.

TABLE 2. BODY WEIGHT MEANS WITH STANDARD ERRORS CORRESPONDING TO VARIOUS TRANSFERRIN GENOTYPES

Type of birds	Genotypes	Average body weight(g) ± SE	
		8-week	12 week
RIR	BB	292 ± 37.77	612 ± 75.69
Crossbred	BB	215 ± 1.18	536 ± 29.43
	BC	236 ± 6.56	431 ± 8.74
Native	BB	194 ± 10.28	340 ± 8.77
	BC	180 ± 11.54	308 ± 4.94

TABLE 3. DUNCAN'S NEW MULTIPLE RANGE TEST FOR BODY WEIGHT AT 8- AND 12- WEEKS OF AGE

Age of chickens	Mean weight (g) of				
	RIR	Crossbred		Native	
	(Tf^{BB})	(Tf^{BB})	(Tf^{BC})	(Tf^{BB})	(Tf^{BC})
8-week	292^{a}	265^{ab}	236^{b}	194^{c}	180^{c}
12-week	612^{a}	536^{a}	431^{b}	340^{c}	308^{c}

[a,b,c] Means with different superscripts are significantly different for same row at 5% level of probability.

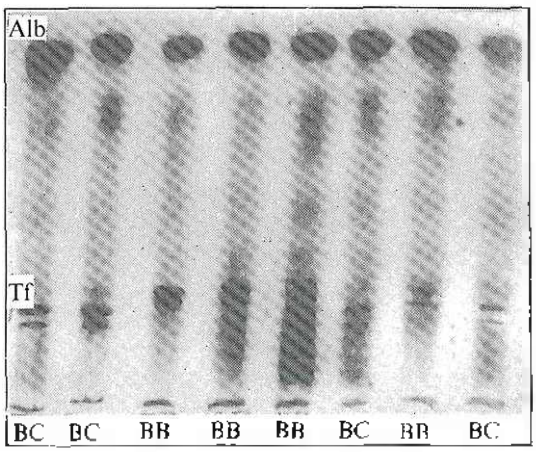

Figure 1. Transferrin types of RIR, Crossbred and Native birds (Tf = Transferrin, Alb = Albumin)

Discussion

Only Tf^{B} allele was found in RIR and both Tf^{B} and Tf^{C} were observed in crossbreds and natives. The frequency of Tf^{B} allele was higher in all genotypes. Similar higher frequency of Tf^{B} allele was observed in the Japanese breeds (Tanabe et al., 1977; Okada et al., 1984). Vishinskii (1970) reported transferrin to be controlled by three genes Tf^{A}, Tf^{B} and Tf^{C} at one locus. This finding of Vishinskii has been supported by Okada et al. (1984) who observed three genes Tf^{B}, Tf^{A} and Tf^{C} in Japanese breeds. The occurance of only two genes, Tf^{B} and Tf^{C} in this study may be due to sampling in a particular region. Again the genotypes of natives were same as those of crossbreds (table 1). In natives, two transferrin genotypes (Tf^{BB} and Tf^{BC}) were observed. But Okada et al. (1988) observed three transferrin genotypes (Tf^{BB}, Tf^{BC} and Tf^{CC}) in the blood sera of indigenous chickens of Bangladesh. The difference could be due to sampling from a wider geographical range that Okada et al. (1988) covered in Bangladesh.

The mean body weight at 8- weeks of age was the highest in the RIR and the lowest in the Natives for Tf^{BC}. The mean body weight of Tf^{BB} for RIR was 292 $\pm$ 37.77; the same for Tf^{BB} and Tf^{BC} for crossbreds were 265 $\pm$ 41.18 and 236 $\pm$ 6.36; and that of Tf^{BB} and Tf^{BC} for native were 194 $\pm$ 10.28 and 180 $\pm$ 11.54 g. These results indicate that Tf locus has no additive effect on 8-week body weight of chickens. Rashid (1982) found similar non-additive effect of transferrin locus on egg production. He, however, found an additive effect of Tf locus on body weight at 18, 38 and 42 weeks of age. Eight week body weight was significantly ($p < 0.01$) affected by transferrin types. The mean 8-weeks weight of RIR for Tf^{BB} varied significantly from others except crossbreds of Tf^{BB} type. Mean 8-week weight of native Tf^{BB} was greater than that of Tf^{BC}. However, this difference was non-significant.

The mean body weight at 12-weeks of age was the highest in the RIR and the lowest in the natives (Tf^{BC}). Transferrin type had significant ($p < 0.01$) effect on 12 week body weight between Tf^{BB} RIR and Tf^{BB} crossbreds. Among the crossbreds, the rate of gain was higher for Tf^{BB} than for Tf^{BC}. The difference in 12 week body weight of crossbred between Tf^{BB} and Tf^{BC} was found to be significant ($p < 0.05$). But in the natives, the difference in 12 week body weight between transferrin type Tf^{BB} and Tf^{BC} was non-significant.

Conclusions

The study indicates that the genotype Tf^{BB} of crossbreds may be effectively and economically grown up to 12th week under Bangladesh conditions.

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