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Egg Quality of Different Chicken Genotypes in Summer and Winter

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Abstract: External and internal quality of 54 fresh eggs from Desi full feathered (d), Desi naked neck (n) and Shaver redbro (r) in summer and winter were tested to compare the genotypes, and to select the genotype for better reproductive fitness. Egg quality traits; egg colour, yolk width, yolk weight and albumen dry matter weight tended to increase in winter in comparison with summer. But, eggs contained significantly higher albumen width and height, yolk height, egg shell weight and thickness, dry matter weight and per cent of yolk in winter than in summer. The genotypes differed significantly for egg quality traits except, egg shell thickness, dry matter per cent of albumen and yolk. The thickest egg shell was observed in desi naked neck. Redbro was the best for egg quality traits. However, Desi naked neck strain produced better quality eggs than that of indigenous full feathered birds.

Key words: Genotypes, eggs, egg quality traits, environment.

Introduction

Egg quality obviously affect the reproductive fitness of the parents. Hatchability of thin shelled egg was 3-9% lower than the thicker shelled eggs (Bennet, 1992). Reduction in egg shell quality affect the depression of hatchability and weakening of the embryos were noted by Peebles and Brake (1987). Egg quality is influenced by genetic and non-genetic factors as season, environment and feed intake (Salahuddin and Howlider, 1991; Christmas *et al.*, 1979 and Matsouka *et al.*, 1980). There is a correlation between egg weight, and albumen and yolk weight (Chung and Stadetman, 1961). Exotic strains produced improved egg weights as well as egg mass, albumen and yolk weight and height, shell thickness in winter and old age in comparison with summer and young age of birds (Cunningham *et al.*, 1960). Egg weight is also varied with the size of the bird (Elahi, 1983). Egg of local chicken is smaller but it contains thicker egg shell (Yami, 1995). As effect of size of the egg, medium size egg is often hatched better than either larger or smaller egg at any season (Dymoza *et al.*, 1954, Carter *et al.*, 1957 and Mengel *et al.*, 1979). Therefore, quality egg is involved to enhance the hatchability. So, the present study was undertaken to compare the egg quality traits of Desi full feathered (d), Desi naked neck (n) and Shaver redbro (r) chicken in summer and winter in Bangladesh to select the quality egg producing genotype in a hot-humid environment.

Materials and Methods

The experiment was carried out between May, 1998 to December, 1998 at Laboratory, Department of poultry Science, Bangladesh Agricultural University, Mymensingh, Bangladesh. A total of 54 eggs of Shaver Redbro (r) (Canadian, Desi full feathered (d) and Desi naked neck (n) (Bangladeshi) chicken were collected to examine the external and internal quality (Table 1).

The following egg quality traits were recorded:
Egg weight (g/egg), Albumen weight (g/egg), Albumen height (mm), Albumen dry matter weight (g/egg), Albumen width (cm), Yolk weight (g/egg), Yolk height (mm), Yolk dry matter weight (g/egg), Yolk width (cm), Blood spot, Meat spot, Double yolk egg(g/bird), Yolk colour, Egg shell weight (g/bird),Egg shell thickness (micro meter) Egg shell membrane weight (g/egg), Egg shell membrane thickness (μm), Dry matter of albumen (%), Dry matter of albumen, Dry matter of yolk (%), Dry matter of yolk (g/egg).

Statistical model: The data was analyzed using General linear mode of SAS computer package programme. The following

Table 1: Plan for the test of egg quality traits

Genotype	Season	No. of eggs						
		Replications						Total eggs
		1	2	3	4	5	6	
Shaver redbro (r)	Summer	2	2	2	2	2	2	12
	Winter	1	1	1	1	1	1	6
Desi full	Summer	2	2	2	2	2	2	12
Feathered (d)	Winter	1	1	1	1	1	1	6
Desi naked	Summer	2	2	2		2	2	12
neck (n)	Winter	1	1	1	1	1	1	6

model was used for analysis:

$$Y_{ijk} = \mu + S_i + ST_j + (S*ST)_{ij} + e_{ijk}$$

Where
Y_{ijk} is the observation on K^{th} replication of Jth genotype in i^{th} seasons.
μ is the overall mean
S_i is the fixed effect of ith seasons (j = 1-2)
S_{tj} is the fixed effect of jth genotype (j = 1-3)
$(S*ST)_{ij}$ is the interaction effect of ith seasons and j^{th} genotypes
e_{ijk} is the random error

The average recorded temperature and Relative humidity in summer, and winter were 27.480C and 82.95%, and 20.740C and 76.72% respectively during investigation.

Results and Discussion

The coefficient of determination (R2) was the highest on egg weight (0.85) and lowest on per cent dry matter of albumen (0.16). The effect of season differed significantly for the traits; egg shell weight, egg shell thickness and egg shell membrane weight, but not differed for egg weight. However, egg weight, egg shell weight, egg shell thickness and egg shell membrane weight were higher in winter than in summer (Table 2).

Table 2: LSQ-means for external and internal egg quality traits of Desi full feathered (d), Desi naked neck (n) and Shaver redbro (r) genotypes (df = 30)

Trait	Season	Genotype (G)			R^2 value	Level of significance+		
		d μ SE	n μ SE	r μ SE		S	D	S*G
Egg weight (g/egg)	S1	37.9	40.5	60.5	0.85	NS	***	NS
		2.3	2.3	2.3				
	S2	38.2	40.2	68.0				
		2.3	2.3	2.3				
Egg shell weight (g/egg)	S1	3.6	3.9	4.4	0.75	***	***	**
		0.2	0.2	0.2				
	S2	3.8	4.2	5.8				
		0.2	0.2	0.2				
Egg shell thickness(micro meter)	S1	330.0	340.0	300.0	0.33	**	NS	NS
		10.0	10.0	10.0				
	S2	340.0	360.0	340.0				
		10.0	10.0	10.0				
Egg shell membrane weight (g/egg)	S1	0.20	0.16	0.25	0.58	***	***	NS
		0.05	0.05	0.05				
	S2	0.31	0.25	0.50				
		0.05	0.05	0.05				
Albumen height (mm)	S1	4.9	5.3	5.5	0.25	NS	*	NS
		0.5	0.5	0.5				
	S2	4.1	5.1	6.1				
		0.5	0.5	0.5				
Albumen width (cm)	S1	6.5	6.3	7.6	0.64	**	***	NS
		0.3	0.3	0.3				
	S2	7.1	6.6	8.7				
		0.3	0.3	0.3				
Yolk height (mm)	S1	16.2	16.2	16.8	0.46	**	**	NS
		0.5	0.2	0.5				
	S2	16.3	17.4	19.2				
		0.5	0.5	0.5				
Yolk width (cm)	S1	3.7	3.8	4.3	0.76	NS	***	NS
		0.1	0.1	0.1				
	S2	3.7	3.7	4.4				
		0.1	0.1	0.1				
Yolk colour	S1	4.6	4.5	4.6	0.49	NS	**	**
		0.2	0.2	0.2				
	S2	4.2	3.1	6.9				
		0.2	0.2	0.2				
Albumen weight (g/egg)	S1	18.4	19.4	29.9	0.77	*	***	NS
		1.8	19.8	1.8				
	S2	20.0	20.7	38.8				
		1.8	1.8	1.8				
Dry matter of Albumen (g/egg)	S1	2.8	2.8	3.5	0.60	NS	***	*
		0.3	0.3	0.3				
	S2	2.5	2.8	4.8				
		0.3	0.3	0.3				
Dry matter of Albumen (%)	S1	14.9	14.1	11.9	0.16	NS	NS	NS
		0.8	0.8	0.8				
	S2	12.7	13.1	12.3				
		1.2	1.2	1.2				
Yolk weight (g/egg)	S1	13.9	14.4	20.3	0.81	NS	***	NS
		0.7	0.7	0.7				
	S2	12.3	13.1	20.0				
		0.7	0.7	0.7				

Dry matter of yolk (g/egg)	S1	6.6	7.0	10.2	0.82	*	***	NS
		0.4	0.4	0.4				
	S2	6.7	7.7	12.1				
		0.4	0.4	0.4				
Dry matter of yolk (%)	S1	48.0	48.0	50.2	0.49	***	NS	NS
		1.4	1.4	1.4				
	S2	54.3	59.0	60.4				
		2.0	2.0	2.0				

+NS, P>0.05; *, P<0.05; **, P<0.01; ***, P<0.001, m = LSQ means, SE = Standard error
S1 = Summer (March-October), S2 = Winter (November-February)

The redbro strain produced heavier egg, egg shell, and shell membrane weight than the desi genotypes (P<0.001, Table 2). Desi naked neck strain produced heavier egg than the Desi full feathered counterparts. Though the genotypes had no significant difference for egg shell thickness, desi chicken produced thicker egg shell than the exotic genotype (P>0.05). However, the egg shell thickness of desi naked neck was thicker than desi full feathered counterparts. There was no significant interaction effect of season and strain for egg weight, egg shell thickness, and egg shell membrane weight (P>0.05), and the significant difference was on egg shell weight (P<0.01). Egg shell weight of d, n and r was higher by 0.2, 0.3 and 1.4g/egg respectively in winter than in summer (Table 2).

The effect of seasons did not differ for albumen height, yolk width, yolk colour, dry matter weight and dry matter per cent of albumen, and yolk, but significantly differed for albumen width, yolk and albumen height, dry matter weight and dry matter percent of yolk (Table 2).

The higher albumen weight was found in winter than in Summer, but the reverse trend was found in summer for yolk weight. The effect of seasons on albumen width, yolk height, albumen weight, dry matter weight and dry matter percentage of yolk were significantly higher in winter than in summer. Higher feed intake and lower water consumption in winter than in summer may be the reason to increase the egg quality. The effect of genotype on per cent dry matter of albumen and yolk was not significant (P>0.05, Table 2). The strains differed significantly for albumen height and width, yolk height and width, yolk colour, albumen and yolk weight, dry matter of albumen and yolk (P< 0.001). The redbro genotype produced eggs, which contained significantly higher these traits than that of desi genotypes. Desi chicken egg contained higher percentage of albumen dry matter than exotic genotype. Of desi genotypes, the eggs of naked neck chicken contained higher albumen and yolk weight, dry matter of albumen and yolk, and dry matter per cent of yolk than the full feathered counterparts.

The significant interaction effects between season and genotype were observed for yolk colour, and dry matter weight of albumen (Table 2). The remaining egg quality traits did not differ due to interaction effects. The redbro genotype had better yolk colour, and albumen dry matter weight and dry matter percent of albumen in winter than in summer. Desi chicken showed the higher percentage of albumen in summer than in winter.

As expected the exotic genotype redbro was better in winter than in summer for egg quality traits except, yolk weight that was consistent with Cunningham *et al.* (1960). On the other hand, egg quality traits of desi birds showed better in summer than in winter except the traits; egg weight, albumen weight and dry matter per cent of yolk supported by Bennion and Warren (1933), and Cunningham *et al.* (1960); Christmas *et al.* (1979). Birds consumed lower feed and more water in summer due to elevated temperature, may be the reason to reduce egg quality traits. Dry matter content of yolk in all genotypes was lower in summer than in winter.

As genetic difference, the genotypes differed significantly for egg quality traits except, egg weight, egg shell thickness, percent dry matter of albumen and yolk that was advocated with the report of Salahuddin and Howlider (1991), Pandey *et al.* (1985). The heavier egg was obtained on redbro genotype as compared to desi genotypes , which was in agreement with Fossido (1986). The thicker egg shell observed in indigenous than exotic redbro genotype is supported by Yami (1995). The yolk colour differed significantly among the genotypes which contradicts the findings of Mafeni (1995). Therefore, as per categorized on egg quality traits, redbro had the highest value, followed by naked neck and desi full feathered birds.

The exotic genotype redbro contained higher amount of yolk (Table 2) but as percentage on egg weight basis it was lower than desi genotypes, which was closely consistent with the findings of Fossido (1986). Dry matter per cent of yolk tended to increase in redbro followed by naked neck and full feathered bird. The redbro genotype contained higher amount of albumen with heavier egg weight (64.25g) than desi full feathered and naked neck as per correlation of egg weight with albumen and yolk weight, consistent with the report of Chung and Stadetman (1961). But per cent of albumen dry matter tended to decrease in redbro compared to desi genotypes, which indicated that eggs of redbro genotype contained higher percentage of moisture than desi chicken. The yolk color, egg shell weight, and dry matter of albumen (g/egg) varied significantly due to the interaction effect of season and genotype.

The findings of this study indicated that Redbro chicken was the best for egg quality traits, but desi chicken showed the better performance in respect of egg shell thickness and per cent albumen dry matter. However desi naked neck produced better quality eggs than desi full feathered chicken. Therefore, desi naked neck may be considered as the best quality egg producer among the desi genotypes.

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