

EGG SHELL PARAMETERS IN PHILIPPINE NATIVE CHICKENS AND THEIR UPGRADES

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Summary

Least square means for egg weight (EW), average shell thickness (ST), shape index (SI), shell surface area (SA) and shell breaking strength (BS) were determined in the Philippine native (PN) and F₂ upgrades with New Hampshire (NH-N) and White Leghorn (WL-N) blood, respectively. Eggs of PN were smaller in size but had higher SI while their egg shells were thinner and weaker than those of the two upgrades. Highest EW, SA and BS means were observed in WL-N. Significant ($p < 0.01$) positive correlations of EW and SI with SA and BS were noted.

(**Key Words**: Egg Shell Parameters, Correlations, Native Chicken)

Introduction

The importance of egg shell quality has been greatly realized in the poultry industry, as the problems arising from handling and marketing of eggs warrant their serious considerations. Results of many studies have shown that shell thickness, shape and size of eggs affect the shell strength (Carter and Morley Jones, 1970; Potts and Washburn, 1974; Curtis et al., 1985 and Janson et al., 1987). The relationships among various egg parameters associated with egg shell quality have also been reported (Tung et al., 1968; Carter, 1975 and Sooncharenying and Edwards, 1989). However, most of the studies reported related to the commercial strains of chicken and information on egg shell quality of native chickens raised under backyard conditions particularly in the Philippines is very limited. This study was made to analyze and compare egg shell quality parameters of the Philippine native chicken and its F₂ upgrades with New Hampshire and White Leghorn.

Materials and Methods

One hundred and twenty six (126) eggs from the Philippine native chickens (PN) were randomly collected from smallhold native chicken raisers in the villages of Batangas province and were brought to the Institute of Animal Science (IAS), College of Agriculture, University of the Philippines at Los Banos (UPLB). Similarly, 91 and 22 eggs were collected from flocks of F₂ upgrades of native chickens with 75% blood composition of New Hampshire and White Leghorn, respectively being maintained at IAS Farm. All eggs collected were kept in an airconditioned room until measurements of all egg shell quality parameters have been made.

Each egg was weighed in an electronic scale (deflection = 10 mg). Egg length (L, cm) and egg breadth (B, cm) were measured using a caliper. Each egg was then broken to take a small sample chip of shell each from the tip, waist (equator) and butt without the shell membrane and its thickness was measured using a microcaliper.

Shape index (SI) for an egg was computed as the ratio between its B and L. Average shell thickness (ST, mm) of each egg was computed as the average of the three measurements of egg shell thickness. The surface area (SA, cm²) of the egg was computed from L, B and EW using the formula of Carter (1975):

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$$SA = 4.5118 \times L^{2.85} \times B^{3.164} \times (EW)^{0.882}$$

The expected egg shell breaking strength (BS, g) of each egg was computed from its EW using the formula suggested by Ar et al. (1979 as cited by Arad and Marder, 1982):

$$BS = 50.86 \times (EW)^{0.15}$$

Data on EW, SI, ST, SA and BS of the three genetic groups and their pooled grouping were analysed and their least square means were compared using GLM procedures (SAS Institute, 1985). Correlation analyses among the parameters were likewise done.

Results and Discussion

Least Square Means and Standard Errors

Least square means and standard errors (SE) of the different egg shell parameters of the three genetic groups of chickens are presented in table 1. The coefficient of variations (CV) for all the parameters ranged from 7 to 11% which were consistent with those reported by Potts and Washburn (1974) but were lower than those reported by Sooncharenying and Edwards (1989). The standard errors in WL-N were higher compared to the other two groups possibly due to the relatively smaller sample size used.

Egg weight (EW) was lowest ($p < 0.01$) in

PN and highest ($p < 0.05$) in WL-N. These egg weights were similar to that of the Sinai Bedouin fowl and its crosses with Leghorn. However, eggs of PN were lighter than the eggs of indigenous chickens in India with the mean weight of 50.2 ± 1.1 g but were heavier than eggs of Kadaknath (42.0 ± 0.7 g) and Aseel (40.3 ± 1.2 g) as reported by Mahapatra and Pandey (1989). The average shell thickness of eggs of PN was lower ($p < 0.01$) than that of both upgrades.

Significant difference in SI values among the three genotypes were observed with SI of PN as the highest ($0.679 \pm .003$) and NH-N ($0.557 \pm .003$), the lowest. These values were less than those reported in five commercial strains (Potts and Washburn, 1974), in Sinai and crossbreds (Arad and Marder, 1982) and in indigenous and purebreds in India (Mahapatra and Pandey, 1989).

The average SA was highest (73.98 ± 1.12 cm²) in WL-N followed by PN (69.17 ± 0.47 cm²) and then by NH-N (68.62 ± 0.55 cm²). These values were different ($p < 0.01$) from each other and were comparable to those reported in Sinai Bedouin fowl and their crosses even though the method of estimation of these values was not the same.

The average BS was lowest in PN (1610.66

TABLE 1. LEAST SQUARE MEANS AND STANDARD ERRORS OF DIFFERENT EGG SHELL PARAMETERS IN THE PHILIPPINE NATVE CHICKEN AND ITS TWO F₂ UPGRADES¹

Genetic Group	N ²	Parameters ³				
		EW (g)	ST (mm)	SI (B:L)	SA (cm ²)	BS (g)
PN	126	43.68 ^a ± 0.43	0.256 ^a ± 0.003	0.679 ^a ± 0.003	69.17 ^a ± 0.47	1610.66 ^a ± 14.38
NH-N	91	46.90 ^b ± 0.50	0.278 ^b ± 0.003	0.557 ^b ± 0.003	68.62 ^a ± 0.55	1719.30 ^b ± 16.93
WL-N	22	52.76 ^c ± 1.02	0.277 ^b ± 0.006	0.589 ^c ± 0.008	73.98 ^b ± 1.12	1914.99 ^c ± 34.43
Overall	239	45.74 ± 0.35	0.266 ± 0.002	0.624 ± 0.005	69.40 ± 0.30	1680.00 ± 11.94
CV %		10.48	10.838	6.284	7.55	9.61

¹ Means in the same column with no common letter are different ($p < 0.05$).

² Refers to the number of observations.

³ EW-egg weight; ST-shell thickness; SI shape index; SA-shell surface area; BS-shell breaking strength.

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± 14.38 g) followed by NH-N (1719.30 ± 16.93 g), while the highest mean value was recorded in the WL-N genotype (1914.99 ± 34.43 g). Differences in the average BS among the three genotypes were highly significant. All three genotypes had lower BS values than those reported in Sinai and their crossbreeds (Arad and Marder, 1982), in five commercial strains (Potts and Washburn, 1974) and also in five genetic groups including the indigenous breeds in India (Mahapatra and Pandey, 1989).

Clearly, the results in this study showed that eggs of PN were smaller in size with thinner and weaker egg shell but with higher shape index as compared to the two F_2 upgrades.

Correlations

The correlation coefficients (r) among the egg shell parameters in PN, HN-N, WL-N and their pooled genotype grouping are presented in table 2. Highly significant correlations of EW with SA and BS were evident in all genotypes studied. Correlation between SA and BS was also highly significant and in agreement with values reported by Potts and Washburn (1974).

EW was found to be positively correlated ($p < 0.05$) with SI in PN and WL-N but not in NH-N. However, a high negative correlation was observed between these two parameters in pooled grouping. The correlations between EW

and ST among the three genetic groups were non-significant and inconsistent among three genotypes. The r values found range from negative in the NH-N group to positive in the other two genotypes. These results were in agreement with Richards and Staley (1967) although a significant ($p < 0.05$) and positive correlation was evident in the pooled grouping. Similar inconsistency in r values among the five genotypes was reported by Potts and Washburn (1974), even though a high positive correlation was reported in Warren and Hubbard strains by them; and in broiler breeder and White Leghorn by Sooncharenying and Edwards (1989). These were in contrast with the high negative r value (-0.44) found between the two parameters as reported by Carter (1975).

A significant ($p < 0.05$) and positive correlation was found between ST and SA in the PN genotype but the correlation between these 2 parameters in other two genotypes and in the pooled grouping was found to be insignificant ($p > 0.05$). The correlation between ST and SI was positive in NH-N and WL-N and negative in PN and pooled grouping but significant ($p < 0.05$) only in NH-N genotype. These results were in agreement with Richards and Staley (1967) and Potts and Washburn (1974) who reported non-significant and mostly negative correlations between the two parameters in various strains. The correlation of ST with BS was found to be

TABLE 2. PEARSON'S CORRELATION COEFFICIENTS (r) AMONG FIVE EGG SHELL PARAMETERS IN THE PHILIPPINE NATIVE CHICKEN AND ITS TWO F_2 UPGRADES¹

Parameters	EW	ST	SI	SA	BS
EW, g		.198**	-.240**	.913**	.999**
		.174	.211*	.981**	.999**
ST, mm	-.099		-.241**	.074	.198**
	.126		-.028	.175*	.174
SI, B:L	-.119	.261*		.051	-.240**
	.529*	.403		.224*	.212*
SA, cm ²	.968**	-.109	-.128		.914**
	.976**	.081	.486		.982**
BS, g	.999**	-.099	-.118	.968**	
	.999**	.125	.527*	.976**	

¹ Upper and lower lines in the above diagonal refer to the coefficients (r) for pooled and PN, respectively; upper and lower lines in the below diagonal refer to the coefficients (r) for NH-N and WL-N, respectively.

* $p < 0.05$; ** $p < 0.01$.

positive but not significant ($p > 0.05$). ST was found to be correlated positively with SA in r both the PN and WL-N groups but correlated negatively in NH-N and positively in the pooled group both being non-significant. SI was found to be positively and significantly ($p < 0.05$) correlated with BS in PN and WL-N but a non-significant negative correlation was evident in NH-N resulting to a significant negative correlation in the pooled group.

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