6. EGG QUALITY COMPARISON OF TWO VIETNAMESE CHICKEN BREEDS (RI AND MIA)

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ABSTRACT

In the context of the valorization of poultry biodiversity, this work represents a step toward a better knowledge of the production abilities of local chicken breeds in Vietnam. Local chicken breeds are indeed particularly well suited for low-input rearing systems, as widely practiced in rural households of Vietnam. The socio-economic importance of these breeds might be underpinned by a market valorization through the mounting of differentiated quality value chains. Such a strategy needs the production potential of these local breeds to be assessed using parameters of egg quality and quantity. This study presents data about egg quality traits in two chicken breeds, the Ri and the Mia. The former is the most widespread breed in Vietnam, while the latter is known to be in danger of extinction. Nineteen parameters of quality of ninety eggs of Ri chickens and sixty eggs of Mia chickens were measured, each for both 40 and 60-weeks old hens to take hens ages into account.Mean egg weight of Mia eggs (44.70g) was significantly ($p<0.001$) higher than that of Ri eggs (41.68g). The yolk to albumen ratio was not significantly different ($p>0.05$) between the two breeds at the age of 40 weeks (Ri: 0.55; Mia: 0.58). For 60-weeks old hens, the ratio became significantly ($p<0.05$) higher in Mia eggs compared to Ri eggs (0.64 vs. 0.57). No significant difference ($p>0.05$) was recorded between the two breeds for parameters used for egg freshness assessment (Haugh's units and pH of albumen and yolk) or eggshell resistance (maximal breakage force). Despite the small sample available for the study (due to the low availability of Mia hens and eggs), significant differences in egg quality traits were thus observed between these two breeds.

Key-words: biodiversity, local chicken, egg quality, eggshell resistance, yolk to albumen ratio, Viet Nam.

INTRODUCTION

In parallel to the industrialization process of western countries in the 19th and 20th centuries, modern poultry production has turned to a true landless, input- and capital-intensive production system, exclusively based on highly productive and specialized hybrid strains. Sustained by the rapid genetic progress allowed by the short life-cycle of poultry as well as by economies of scale (increasing returns), a highly concentrated economic sector has emerged, where the global production relies on few major genetic types. Nowadays a rapid demand-driven expansion of livestock sector in the developing countries is occurring (Moula, 2012).

Aviculture is a very important sector of agriculture in Vietnam, occupying the 2nd position after the swine sector. It is dominated by local breeds with 158 millions local poultry. The local hen breeds combined with the local duck breeds, represent over 89 % of the total national Vietnamese avian population (Eaton *et al*., 2006).

In the context of the valorization of poultry biodiversity, this work represents a step toward a better knowledge of the production abilities of Vietnamese local chicken breeds. Local chicken breeds are indeed particularly well suited for low-input rearing systems, as widely practiced in rural households of Vietnam. The socio-economic importance of these breeds might be underpinned by a market valorization through the mounting of differentiated quality value chains. Such a strategy needs the production potential of these local breeds to be assessed from parameters of egg quality and quantity.

This study presents data about egg quality traits in two chicken breeds, the Ri and the Mia. The former is the most widespread breed of Vietnam, while the latter is known to be in danger of extinction. Quality of the eggs is assessed through the freshness of the eggs, represented in this study by Haugh's units (HU), the soundness of the shell, which is the second most important economic quality of eggs, represented by the eggshell thickness and by the maximal breaking force of the shell (Moula *et al*., 2010), and the yellow to white ratio, for which high proportion of yellow are sought because it has a significant impact on the dry matter of eggs which is an essential criterion in the industry.

I. MATERIALS AND METHODS

Egg quality measures (egg weight, yolk weight, egg shell weight, albumen weight, percentage of albumen, percentage of yolk, percentage of egg shell, yolk-albumen ration, albumen height, Haugh's units, yolk diameter and yolk color) were taken the day after egg collection in the laboratory of the Faculty of Animal Science and Aquaculture of Hanoi University of Agriculture (Vietnam). The analyses were conducted using hens aged of 40 and 60 weeks. Eggs weights were measured to the nearest 0.01g. The lengths and widths were obtained using an electronic sliding caliper (precision 0.01mm), so that an egg shape index, defined as the ratio between length and width multiplied by 100 (Moula et al., 2009), could be calculated. Maximal breaking force (Fmax, in Newton) was determined using the static compression method (De Ketelaere *et al*., 2002) with an universal tensile and compression test machine shown in Fig. 1. Eggs were placed horizontally between two steel plates squeezing them at a speed of 10 mm/min. Fmax was the force at which egg breaking occurred (maximum breaking force). Individual Haugh units (HU) were calculated from the height (H) of the albumen and egg weight (W) using the simplified HU formula (Haugh, 1937):

$$\mathbf{HU = 100 \log (H - 1.7\, W^{0.37} + 7.6)}$$

The diameter of yolk was measured using an electronic micrometer. The 15-levels Roche scale was applied to yolk color, a score of 1 indicating light yellow and 15 deep orange. The yolks were carefully separated from the albumen. The shell, including membranes and yolks were weighted separately (accuracy of 0.01g). Albumen weight was determined by subtracting yolk and shell weights from total egg weight. The shell thickness was measured at three different random points in the equatorial shell zone using an electronic micrometer (precision 0.01mm). The calculated average was used as the trait measure. Tyler (1964) indeed reported the eggshell thickness to be slightly thinner but more stable in the equatorial shell zone compared to other shell zones.

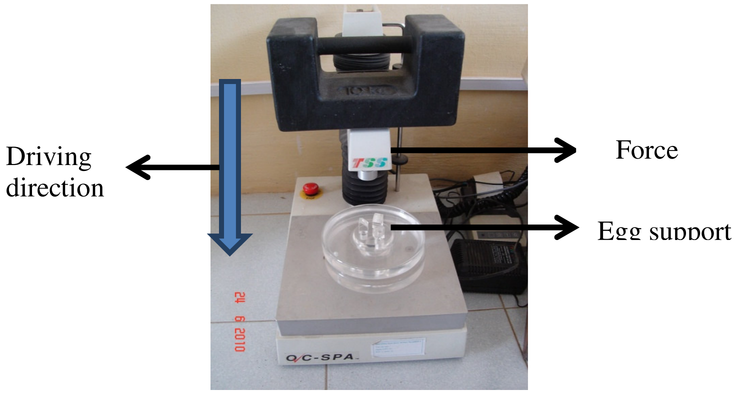

Fig.1. Universal Tensile System used for measurement of the maximum breaking force

The SAS Software (Statistical Analysis System, 2001) was used for all statistical analyses. Breed and age effect on each parameter was assessed by the following general linear model: $$y_{ijk}=\mu + A_i + B_j + (AB)_{ij} + e_{ijk}$$

With: y= the studied parameters measured on the egg; µ: mean; A: effect of breed (i= Mia and Ri); B: effect of age (j= 40 and 60 weeks); AB= interaction between breed and age; e= residual effect.

III. RESULTS

Quantitative traits measured on eggs of 40-weeks and 60-weeks old hens are presented in Table 1 and 2. Mean egg weight of Mia was significantly ($p<0.001$) higher than that of Ri. The yolk to albumen ratio was significantly different ($p<0.01$) between the two breeds. No significant difference ($p>0.05$) was recorded between the two breeds for egg freshness assessment (Haugh's units) and eggshell resistance (maximum breaking force).

Table 1. Least square means (lsmean ± SE) for interior egg quality traits

Parameters	Age (weeks)	Breeds		Level of signification			R^2
		Mia	Ri	Age	Breed	Age*Breed	
Egg weight (g)	**40**	42.79±0.69^a	38.79±0.54^b	***	***	*	0.41
	60	46.60±0.69^a	45.21±0.60^b				
Yolk weight (g)	**40**	14.08±0.37^a	12.32±0.27^b	***	***	ns	0.33
	60	15.76±0.34^a	14.67±0.30^b				
Egg shell weight (g)	**40**	4.21±0.10^a	3.80±0.08^b	***	***	ns	0.45
	60	5.08±0.10^a	4.59±0.08^b				
Albumen weight (g)	**40**	24.23±0.68	22.73±0.51	***	ns	ns	0.15
	60	25.76±0.63	26.04±0.56				
% Albumen	**40**	56.90±0.83	58.22±0.62	ns	**	ns	0.74
	60	55.03±0.77^a	57.43±0.68^b				
% Yolk	**40**	33.20±0.78	31.82±0.58	ns	*	ns	0.04
	60	34.08±0.73	32.45±0.65				
% Egg shell	**40**	9.86±0.18	9.83±0.14	*	*	*	0.14
	60	10.90±0.18	10.15±0.16				
Y:A ratio (%)	**40**	0.58±0.02	0.55±0.01	ns	**	ns	0.10
	60	0.64±0.02^a	0.57±0.02^b				
Albumen height (.01mm)	**40**	5.51±0.25	5.67±0.20	*	ns	ns	0.06
	60	4.78±0.25	5.27±0.22				
Haugh's units	**40**	78.92±1.75	80.88±1.36	**	*	ns	0.10
	60	72.49±1.72	76.14±1.51				
Yolk diameter (mm)	**40**	39.12±0.40^a	36.53±0.30^b	*	***	*	0.23
	60	39.05±0.37^a	38.13±0.32^b				
Yolk coloration	**40**	10.89±0.18	10.55±0.13	*	**	ns	0.10
	60	10.72±0.17^a	10.08±0.15^b				

On a same row, values bearing a same letter a statistically not different ($p < 0.05$).
***: $P < 0.001$; **: $P < 0.01$; *: $P < 0.05$; $P \geq 0.05$. R^2: coefficient of determination

Table 2. Least square means (lsmean ± SE) for exterior egg quality traits

Paramètres	Age (weeks)	Breeds		Level of signification			R^2
		Mia	Ri	Age	Breed	Age*Breed	
Egg length (mm)	**40**	50.73±0.36[a]	48.86±0.28[b]	***	***	ns	0.32
	60	52.56±0.36[a]	50.70±0.31[b]				
Egg widh (mm)	**40**	39.15±0.24[a]	37.89±0.19[b]	***	*	**	0.27
	60	39.53±024	39.76±0.21				
Egg Shape	**40**	76.85±0.57	77.51±0.45	ns	**	*	0.10
	60	75.65±0.57[a]	78.56±0.49[b]				
Eggshell thickness ($x10^{-2}$)	**40**	32.09±0.57	32.50±0.45	***	***	***	0.40
	60	32.31±0.58[a]	26.56±0.51[b]				
F max (newton)	**40**	36.50±1.21	36.66±0.95	*	ns	ns	0.06
	60	40.79±1.23[a]	37.89±1.05[b]				

On a same row, values bearing a same letter a statistically not different ($p < 0.05$). ***: $P < 0.001$; **: $P < 0.01$; *: $P < 0.05$; $P \geq 0.05$. R^2: coefficient of determination

IV. DISCUSSION

The influence of age on the egg composition is already reported in numerous studies (Nys, 1986; Moula *et al.*, 2012). In the present study, egg weight, yolk weight, egg shell weight and albumen weight increase according to age. However the difference is not very important for the main quality traits of eggs (freshness, egg shell strength, and the ratio yellow/white and egg weight).

Egg weight in this study was lower than industrial egg while the yolk, yolk-albumin ratio was higher. The soundness of the shell was similar (De Ketelaere *et al.*, 2002). The freshness of the egg is represented in class AA According to USDA grade (USDA, 1975).

V. CONCLUSION

The performances of both breeds appear to be highly interesting since market demand is for eggs with a higher yield in dry mater (high yolk to albumen ratio) and eggs with strong shell (maximal breakage force); this observation is of particular interest when considering that none of these breeds underwent any previous selection process, which possibly implies that even more benefits could be obtained after selection. Further breeding for these traits could thus be considered in these local breeds.

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