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Technical Note

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What Determines Hatchling Weight: Breeder Age or Incubated Egg Weight?¹

ABSTRACT

Two experiments were carried out to determine which factor influences weight at hatch of broiler chicks: breeder age or incubated egg weight. In Experiment 1, 2340 eggs produced by 29- and 55-week-old Ross® broiler breeders were incubated. The eggs selected for incubation weighed one standard deviation below and above average egg weight. In Experiment 2, 2160 eggs weighing 62 g produced by breeders of both ages were incubated. In both experiments, 50 additional eggs within the weight interval determined for each breeder age were weighed, broken, and their components were separated and weighed. At hatch, hatchlings were sexed and weighed, determining the average initial weight of the progeny of each breeder age. Data were analyzed using the Analyst program of SAS® software package. In Experiment 1, the weight difference between eggs produced by young and mature breeders was 10.92 g, and the component that mostly influenced this difference was the yolk (7.51 g heavier in mature breeders, compared with 4.23 g difference in albumen and 0.8 g in eggshell weights). Hatchling weight difference was 9.4 g higher in eggs from mature breeders. In Experiment 2, egg weight difference was only 0.74 g, but yolk weight was 4.59 g higher in the eggs of mature breeders. The results obtained in the present study indicate that hatchling weight is influenced by egg weight, and not by breeder age.

INTRODUCTION

A chicken egg generally consists of 58.5% albumen, 31% yolk, and 10.5% shell, but this composition varies according to genetic strain and breeder age (Vieira & Moran, 1999).

Chick weight at hatch is directly related to egg weight, corresponding to 62 to 76% of egg weight. This correlation between increases after the 11th day of incubation and may remain the same during the entire rearing period (Wilson, 1991).

Breeder age strongly influences egg weight, as well as egg quality and composition. Young breeders tend to produce lighter eggs, and consequently, lighter day-old chicks (Dalanezi *et al.*, 2004); however, egg with the same weight can be produced by breeders of different ages as well breeders of the same age can produce eggs with different weights. Some studies showed that chick weight is independent of breeder age and it is only influenced by egg weight (Pinchasov, 1991).

Egg weight increases with breeder age due to the increase in yolk size, whereas the variation in the weight of the eggs produced by breeders of the same age results from an increase in albumen proportion (Lima *et al.*, 2001). It must be mentioned that eggs with the same weight, independently of breeder age, produce day-old chicks with the same weight and quality.



Eggs produced by breeders of different ages require the same incubation time, but not the same temperature (Almeida *et al.*, 2006), as eggs from older breeders tend to produce more heat during incubation than those from younger breeders. Also, as the embryo develops, its metabolic heat production increases, which demands lowering the temperature supplied by the incubator. Overheating embryos negatively affects hatch, as well as the development of the chick's digestive and immune systems (Valle, 2008).

Considering the influence of hatchling weight on the overall performance of a broiler flock, the objective of the present study was to determine, by evaluating the weights of whole eggs, their components and of hatchlings produced by 29- or 55-week-old breeders, what has the strongest influence on initial weight: breeder age or incubated egg weight.

MATERIALS AND METHODS

Two experiments were carried out with two flocks of Ross® broilers breeders of different ages (29 and 55 weeks old) each. In Experiment 1, 2340 eggs were incubated (1200 and 1140 eggs from young and mature breeders with different body weights, respectively). Eggs weighed one standard deviation below and above average egg weight, representing 66% of the population produced by each flock, obtained from a commercial breeder farm.

In Experiment 2, 2160 eggs (1080 eggs from young and mature breeders with similar body weight). Egg weight was standardized to approximately 62 g for both breeder ages, representing around 25% of the egg population in each flock.

The experiments were carried out for 13 weeks. In order to determine the weight of the eggs to be selected for incubation, 100 eggs were initially sampled for each breeder age, individually weighed, and egg weight mean and standard deviation were calculated. After the determination of egg weights to be selected, eggs produced by breeders of each age were individually weighed, classified according to weight interval and placed in incubation trays, each with a capacity of 30 eggs. Trays were weighed to determine the mean weight of eggs effectively incubated. Eggs were incubated in a commercial hatchery for 18 days in a single trolley in multiple-stage setter, and later transferred to a single hatcher.

In each experiment, 50 eggs within the weight interval determined for each breeder age were selected, weighed, broken, and the yolk, albumen

and eggshell were separated and weighed to obtain their absolute and relative (% of egg weight) weights for each breeder age. These data were statistically analyzed using the Analyst program of SAS® statistical package.

At hatch, chicks from each breeder flock were sexed and weighed to obtain the average weight of males and females produced by young and mature breeders. Six chicks per breeder age were sacrificed, and their yolk sac was removed and weighed to determine residual yolk content.

RESULTS AND DISCUSSION

Average egg weight, egg components weight, and day-old chick weight produced by young (29 weeks) and mature (55 weeks) breeders in each experiment are shown in Table 1.

In Experiment 1, the eggs produced by 55-week-old breeders presented higher average weight than those produced by 29-week-old breeders. Although all egg components were heavier in the eggs of mature breeders, the largest weight difference obtained between breeder ages was the yolk. In this experiment, the average weights of male and female chicks derived from 29- and 55-week-old breeders were 38.6 and 48.0 g, respectively, representing a 9.4 g difference in initial weight, whereas egg weight difference was around 11.0 g. Because yolk sac weight at hatch was similar between breeder ages, it may be inferred that residual yolk content did not influence initial chick weight.

The hatchability, determined as the percentage of hatched eggs relative to the number of set eggs, was similar between breeder ages.

In Experiment 2, although egg weights were statistically different, this does not have any practical meaning as this difference may have been detected by the high number of observations used in the analysis. Therefore, egg weight may be considered similar (62.03 vs. 62.77 g), as the weight difference was of merely 0.74 g.

Although the eggs of 55-week-old breeders presented higher yolk weight, this did not influence hatchling weight (43.4 g and 43.0 g, respectively, for 29- and 55-week-old breeder eggs). This indicates that hatchling weight is affected only by egg weight, independently of yolk weight and breeder age. Yolk sac weight, as previously observed in Experiment 1, was similar between hatchlings derived from young and mature breeders, and did not influence initial weight.



Hatchability (percentage of hatched eggs relative to the number of set eggs) of eggs produced by mature breeders was 8.3% lower compared with the eggs of young breeders. Although the cause of this lower hatchability was not investigated in the present study, it is possible that the temperature of the multiple-stage machine was adequate for the eggs of 29-week-old breeders, but high for those of 55-week-old breeders, causing late embryo mortality (Campos, 2000).

Table 1 – Average weight of eggs (n=50), egg components and day-old chicks derived from breeders of two different ages in Experiments 1 and 2.

Experiment 1				
Parameters	Breeder age (weeks)		p value	CV ¹
	29	55		
Eggs (g)	57.84b	68.76a	<0.0001	2.64
Albumen (g)	34.72b	38.95a	<0.0001	5.36
Albumen (%)	59.82b	55.25a	<0.0001	4.29
Yolk (g)	15.48b	22.99a	<0.0001	7.03
Yolk (%)	26.67b	32.64a	<0.0001	7.03
Eggshell (g)	7.27b	8.07a	<0.0001	7.62
Eggshell (%)	12.53b	11.45a	<0.0001	7.48
Hatchability (%)	87.50	86.50
Day-old chicks (g)	Males	40.00	48.40	..
	Females	37.20	47.60	..
	Mean	38.60	48.00	..
Yolk sac at hatch (g)	4.370	4.932	>0.5000	>0.5000
Experiment 2				
Parameters	Breeder age (weeks)		p value	CV ¹
	29	55		
Eggs (g)	62.03b	62.77a	0.0085	2.95
Albumen (g)	36.76a	34.33b	<0.0001	4.96
Albumen (%)	60.84a	54.81b	<0.0001	3.45
Yolk (g)	16.11b	20.70a	<0.0001	6.38
Yolk (%)	26.68b	33.06a	<0.0001	6.22
Eggshell (g)	7.33	7.52	0.7585	10.0
Eggshell (%)	12.14	12.02	0.6308	9.87
Hatchability (%)	85.20	76.90
Day-old chicks (g)	Males	43.50	43.20	..
	Females	43.20	42.70	..
	Mean	43.40	43.00	..
Yolk sac at hatch (g)	4.925	4.228	>0.5000	>0.5000

Means followed by different letters in the same row are different by the F test (p<0.05). 1 - Coefficient of variation (%).

In both experiments, the composition of the eggs produced by young and mature breeders was different, but hatchling weight relative to egg weight was similar, varying between 67 and 70%, which is consistent with the interval of 62 to 76% reported in literature (Wilson, 1991). Therefore, egg composition does not seem to influence hatchling weight. The differences in

albumen and yolk proportions in the eggs produced by breeders of different ages, considering the differences in protein, lipid, vitamin, mineral, and water content, may result in different body composition and different tissue and organ development of the resulting chicks. However, this was not determined in the present study, and the influence of these factor on broiler development warrants further research.

CONCLUSION

The results obtained in the present study indicate that hatchling weight is influenced by egg weight, and not by breeder age, as eggs with similar weights results in hatchlings with similar weight.

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