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Relationship between hatchling length and weight on later productive performance in broilers

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Hatchling length and weight are used as tools to measure hatchling quality. However, the relationship between these parameters and later performance are not well known. This review evaluates the relationship between hatchling length or weight and slaughter weight, breast meat yield and feed conversion ratio (FCR) in both male and female broilers.

Datasets from two trials were compared. In the first, hatchling length and weight of 100 male and 100 female broilers were measured and body weight and breast meat yield were determined at 38 days of age. In experiment 2, hatchling length of 187 female and 230 male broilers was measured and body weight was determined at 21 and 42 days of age. Feed intake was determined between 21 and 42 days of age.

In both experiments, male broilers showed a positive relationship between hatchling length and slaughter weight or breast meat yield, but no relationship was found with hatchling weight. The relationship between hatchling length and performance in female broilers differed between the two experiments. In female broilers, a negative relationship between hatchling weight and breast meat yield was found. No relationship between hatchling length and FCR in both male and female broilers was found. From this limited dataset, it can be concluded that hatchling length seems to be a better parameter to predict subsequent chick performance, excluding FCR, than hatchling weight, but gender needs to be taken into account.

Keywords: broilers; hatchling length; hatchling weight; slaughter weight; breast meat yield; feed conversion ratio

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Introduction

Hatchling quality reflects the development of the embryo during incubation and might predict the later performance of the bird in the field as well. Various studies (Lourens and Van Middelkoop, 2000; Joseph *et al.*, 2006; Hulet *et al.*, 2007) have shown that sub-optimal incubation conditions may have an impact on hatchability, hatchling quality and subsequent performance. When incubation fits the requirements of the bird, embryonic development is optimised and can lead to improved performance later in life. An optimal development of the bird's body at hatch may also include a better development of the digestive tract. This can be reflected in a better utilization of nutrients and, consequently, improved feed conversion ratio (FCR).

Hatchling quality can be measured by different methods, including hatchling length and weight (Hill, 2001; Wolanski *et al.*, 2006). Relationships between these parameters and performance, including FCR, are hardly known for broilers. The datasets compared below evaluated the relationship between hatchling length or weight and slaughter weight, breast meat yield and FCR in male and female broilers.

First experimental dataset

The first data analysed were derived from a trial using 220 eggs, weighing 64-67 g, from a Ross broiler breeder flock of 38 weeks old. Eggs were incubated at an eggshell temperature of 37.8°C in a HatchTech MidiClimer 57600, Veenendaal, The Netherlands. Birds were sexed at hatch and 100 males and 100 females were wing clipped and length and body weight were determined. Hatchling length was measured by stretching the bird along a ruler and measured from the tip of the beak to the tip of the middle-toe, excluding the nail.

Male and female broilers were housed during the first two weeks in a commercial broiler house together with other broilers. After two weeks, chicks were separated from the other birds in the broiler house and the density was 13 animals/m². Birds were fed *ad libitum* throughout the experiment.

Slaughter weight and breast meat yield were measured at 38 days of age. Data of male or female broilers were analyzed separately for differences with the regression procedure of SAS (version 9.1, 2002) using the model:

$$Y = \mu + H + e$$

with Y= body weight or breast meat yield at 38 days of age, μ= overall mean, H= hatchling length or weight, and e= residual error.

In male broilers, a positive relationship was found between hatchling length and slaughter weight and between hatchling length and breast meat yield (*Table 1*). No relationship was found between hatchling weight and slaughter weight or breast meat yield in male broilers (*Table 1*). In female broilers, a negative relationship was found between hatchling weight and breast meat yield (*Table 1*).

Table 1 Relationship between hatchling length and weight and breast meat yield at 38 days of age in male and female broilers.

Hatchling quality parameter	Body weight at 38 days	Breast meat yield at 38 days
Hatchling length of males		
r	0.36	0.25
β (g/cm)	246.2	44.7
P-value	<0.01	0.04
Hatchling length of females		
P-value	0.88	0.97
Hatchling weight of males		
P-value	0.21	0.28
Hatchling weight of females		
r	-	0.24
β (g/g)	-	-9.5
P-value	0.11	0.04

Second experimental dataset

In the second dataset, 187 females and 230 males were randomly selected at hatch from Hybro pure broiler line flocks ranging in age between 27 and 39 weeks. Birds were wing clipped and hatchling length was measured. Male and female broilers were raised in two separate commercial broiler houses until 21 days of age. From 21 to 42 days of age, broilers were housed individually to measure feed intake. Birds were fed *ad libitum* throughout the whole experiment. Body weight was determined at 21 and 42 days of age.

Body weights of male or female broilers were analyzed with the regression procedure of SAS (version 9.1, 2002) using the model:

$$Y = \mu + H + A + e$$

with Y= body weight at 42 days of age, μ= overall mean, H= hatchling length as a covariate, A= age of the broiler breeder flock as a class variable, and e= residual error.

Data of FCR of male or female broilers were corrected to a body weight of 2400 g and analyzed with the same model.

In males, hatchling length tended to be positively related to body weight at 42 days of age (r= 0.26; β= 20.0 g/cm; P= 0.06). In females, hatchling length was positively related to body weight at 42 days of age (r= 0.30; β= 95.5 g/cm; P<0.05). No relationship (P>0.05) between hatchling length and FCR was found for both male and female broilers.

Comparing these trials with other datasets

These experiments show that hatchling length in male broilers seems to have a predictive value for final body weight (β= 246.2 and 20.0 g/cm, respectively) and breast meat yield (β= 44.7 g/cm). Other studies of Baarendse *et al.* (2006; β= 134 g/cm) and Wolanski *et al.* (2006) found as well a positive relationship between hatchling length and body weight at 35 days or 14 days of age in male broilers, respectively. Differences in the slope of the

relationship between the studies might be due to difference in the number of animals or the age or strain of the broiler breeder flock.

Wolanski *et al.* (2004) also found a positive relationship between hatchling weight and body weight at six weeks of age, without taking gender into account. In the experiments compared above, the relationship between hatchling length and performance in female broilers differed between the two experiments. The relationship between hatchling length and slaughter weight or breast meat yield differ between male and female broilers. This suggests that gender needs to be taken into account when hatchling length is used for the prediction of subsequent performance.

Hatchling weight seems not to have a predictive value for performance in males in this study. Different studies showed conflicting results between hatchling weight and later performance (Wilson, 1991; Tona *et al.*, 2005). Egg weight might influence some of these results as it is correlated to hatchling weight and sometimes also to subsequent performance (Wiley, 1950; Shanawany, 1987; Pinchasov, 1991; Wilson, 1991). However, egg weight can be discounted from the data regarding selecting the eggs on egg weight in the first dataset analysed.

Hatchling weight may not be a good predictor for subsequent performance, because it includes an unknown amount of residual yolk. Wolanski *et al.* (2006) found that the amount of residual yolk can vary between 0.8 to 10.6 grams. Wolanski *et al.* (2004) found as well a negative relationship between the amount of residual yolk and the yolk free body mass. This indicates that a hatchling with a larger residual yolk has a lower yolk-free body mass. The development of body tissues of this bird was decreased during incubation and may also decrease the performance later in life. The development of the body tissues of the hatchling is unknown when body weight is measured and body weight seems therefore not to be a good predictor of subsequent performance.

The second experiment found no relationship between hatchling length and feed conversion ratio in both male and female broilers. This may indicate that longer hatchlings do not have a more efficient utilization of nutrients.

Conclusions

In conclusion, hatchling length rather than hatchling weight seems to have a predictive value in males for slaughter weight and breast meat yield. In females, this is less clear. Additionally, FCR seems not to be related with hatchling length.

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