Effects of different daily protein intake on reproduction in broiler breeder females

R.A. van Emous, R.P. Kwakkel, M.M. van Krimpen, W.H. Hendriks

Wageningen UR, Livestock Research, PO Box 65, NL-8200 AB Lelystad, the Netherlands
Animal Nutrition Group, Department of Animal Sciences, Wageningen University, PO Box 338, NL-6700 AH Wageningen, the Netherlands

Introduction

Broiler breeder production is an important link in the poultry meat chain. The main goal in broiler breeder production is to provide fertilized settable eggs, for the production of healthy and robust day-old chickens (Zuidhof et al., 2007). Almost 6 million broiler breeders at 200 breeder farms in the Netherlands jointly produce almost 1 billion hatching eggs a year. During the last decade, a major problem in broiler breeder production is a decreasing trend in fertility and hatchability of eggs, especially during the second part of the laying period. Besides many factors, nutrition can play a major role. A negative effect of a high dietary CP during the laying period on fertility and hatchability of eggs has been reported by Pearson and Herron (1982), Whitehead et al. (1985), and Lopez and Leeson (1995). Moreover, Pearson and Herron (1982) reported that a high protein compared to a low protein intake during the laying period, resulted in an increased mortality and malformation of embryos. However, little is known about the effects of different dietary energy levels on reproduction of a modern breeder strain. The aim of the study was to determine the effects of different dietary energy levels on the reproduction of Ross 308 breeders.

Material and Methods

A flock of 2,520 Ross 308 female broiler breeder (Aviagen-EPI, Roermond, The Netherlands) were introduced to an experimental farm. At the start of laying period (at 22 wk of age) hens were allotted to 36 pens (70 hens per pen) in two identical rooms. Males were reared elsewhere and introduced into the pens when the hens were 23 wk of age (8 per pen; 11.4% male/female ratio). The birds were housed in 2 identical climate-controlled rooms, within 18 floor pens (4.5 x 2.5 m) with wood shavings and an elevated floor (1.2 x 2.0 m) with plastic slats. The hens where fed by an automatic pan feeding system including 5 pans with a male exclusion system. Males were fed by one manual feeding pan per pen on a minimum height of 50 cm to prevent female access to the feed. Standard management was provided advised by the breeding company. Between 22 and 45 wk of age (first phase of the laying period), hens were fed 3 different dietary energy levels: high, standard, or low (3,000, HEl1; 2,800, SEl1; and 2,600, LEl1, kcal/kg AMEn, respectively). Between 45 and 60 wk of age (second phase of the laying period), hens were fed 2 different dietary energy levels: standard or high (2,800, SEl2; and 3,000, HEl2, kcal/kg AMEn, respectively). Diets during the laying period were formulated to be isonitrogenous . During the experiment, birds were maintained on the same breeder recommended target BW and feed allocation was adjusted on a weekly base to BW gain (Aviagen-EPI, Roermond, The Netherlands). All eggs were collected daily and recorded every week to determine daily and weekly egg production per pen. The total number, settable (above 50 g), small (under 50 g), double yolk, abnormal shell, and dirty eggs were calculated per pen, per week and per phase of the laying period. Starting at 28 wk of age, 150 eggs per pen from 3 to 4 d of production were, transported and set, after a 5 d store period, in an incubator at a commercial hatchery at a 5-weekly interval (Probroed & Sloot, Meppel, The Netherlands) and incubation traits were recorded.

Results and Discussion

Birds fed the SEl1 diet produced slightly more total (P = 0.063) and settable (P = 0.086) eggs during the first phase of the laying period compared to the birds fed the HEl1 and LEl1 diets. In contrary to these findings, Pishnamazi et al. (2011) found no effect on egg production when birds were fed two different dietary energy levels (2,900 vs. 2,800 kcal/kg ME) to 33 wk of age. Also Joseph et al. (2000) did not find an effect of a same daily energy and 10% lower CP intake on total egg production. However, number of settable eggs was lower because the decreased egg weight.

In the current study no effect on egg weight during the first phase of the laying period was found. However, an increased carryover effect on egg weight during the second phase of the laying period was found when birds were fed the HEl1 diet (low daily CP/AA intake) compared to the LEl1 birds (high daily CP/AA intake). A more or less comparable effect was observed by Sun and Coon (2005) when birds were fed a 5.5% higher dietary energy level. Feeding birds the HEl1 diet resulted in an increased mortality between 22 and 45 wk of age compared to the birds fed the SEl1 and LEl1 diet. No carryover effect was found on the second phase of the laying period, however, mortality of the total laying period was higher for the HEl1 birds compared to the other treatments (9.4 vs. 6.5 and 5.7%, respectively). Contrary to our results, Sun and Coon (2005) did not find an effect on mortality when birds were fed a high or low energy diet during the entire laying period. The difference in total mortality in the current experiment was caused by a higher mortality due to leg problems. The major part of the leg problems was induced by rupture of the gastrocnemius tendon which is known as a cause of lameness in poultry (Crespo and Shivaprasad, 2011). Egg production and mortality were not affected during the second phase of the laying period by dietary energy level which is in agreement with Sun and Coon (2005) who fed breeders a high or low energy diet (2,970 vs. 2,816 kcal/kg ME) during the total laying period. Egg weight of birds fed the HEl2 diet was 0.4 g lower than for birds fed the SEl2 diet due to the lower daily CP/AA and linoleic acid intake. A high energy diet (and as a consequence a 10% lower daily CP/AA intake) had no effect on fertility, but improved hatchability of fertile eggs, which in turn was caused by a decreased embryonic mortality between d 3 to 21 of incubation. The effect of daily CP intake on incubation traits was previously reported by Pearson and Herron (1982) and Whitehead (1985). The improved incubation traits in the current study probably also positively affected the quality of the embryos resulting in a lower number of second grade chicks. This was previously underlined by Pearson and Herron (1982) who found that the proportion of dead and malpositioned embryos could be lower when the daily protein intake was decreased from 27.0 to 21.3 g protein per animal per day.

In conclusion, changing the dietary energy level compared to the standard during the first phase of the laying period resulted in slightly negative effects on production while a high-energy diet during the second phase of the laying period showed positive effects on incubation traits.

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