Effect of Egg powder on performance of broilers

Research carried out by

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Introduction

Since January 2006 the EU has banned all sub-therapeutic use of antibiotics. The search for effective alternatives is still going on.
A lot of work has been done on egg yolk antibodies. To increase these antibodies in the egg yolk, hens were immunized. Antibodies were then extracted from the yolk. This results in a very expensive additive of which the effectiveness for the reduction of intestinal infections are very variable.

In a lot of cases there is not a clinical infection, but performance of broilers is just not optimal due to sub-clinical infections. What organism, or organisms, are causing the sub-optimal performance, is then not known.
The use of whole egg powder as a feed additive may then be a way to improve broiler performance in an economical way.

To investigate the effect of an addition of 5% egg powder to broiler diets (starter or starter + grower diet) on broiler performance, an experiment was carried out with three groups of broilers:
A control group not receiving any egg powder
A group receiving egg powder in the starter and the grower period
A group receiving egg powder only in the starter period.

Body weight, feed and water intake and mortality rate were measured and growth rate and feed conversion efficiency were calculated.

1 Materials and methods

Birds and housing
A number of 272 one-day-old female broilers (Ross 308) were purchased from the hatchery. On the day of arrival, they were wing-banded, weighed and randomly distributed over 34 wire-floor, suspended cages. Each cage was provided with thick foil and litter.

Continuous lighting was provided throughout the experiment. The temperature in the cage at arrival was 32°C and was gradually decreased to ambient temperatures during the experiment.

Dietary treatments
Four different diets were produced by Research Diet Services BV in Wijk bij Duurstede, The Netherlands: two starter diets (week 1 – 2) and two grower diets (week 3 – 4). All diets were composed without antibiotic growth promoters.

The experiment consisted of three dietary treatments:
Treatment A *(Control/Control)*: broilers received the control starter and the control grower/finisher diet.
Treatment B *(Egg powder/Egg powder)*: broilers received the egg powder starter diet and the egg powder grower/finisher diet.
Treatment C *(Egg powder/Control)*: broilers received the egg powder starter diet and the control grower/finisher diet.

The composition of all experimental diets is presented in Table 1.

Feed and water were available *ad libitum*.

The total experiment consisted of 34 cages (treatment A, 12 cages; treatment B, 11 cages; treatment C, 11 cages). The experiment started with 8 birds per cage during the starter period. On day 21 of the experiment, 2 birds per cage were removed *at random* from the trial.

Table 1. Composition of the experimental starter and grower diets (g/kg).

Ingredient	*Starter diet Control*	*Starter diet Egg powder*	*Grower diet Control*	*Grower diet Egg powder*
Egg powder		50.0		50.0
Corn	300	300	150	170
Wheat	199	214	350	350
Peas	100	100	100	100
Barley			11.0	
Soya hipro	250	250	244.4	185.8
Corn gluten feed	46.4	4.1	32.0	50.0
Soya oil	24.4	13.9	31.2	9.0
Palm oil	17.5	10.0	52.0	47.9
Natuphos 5000 FTU/G	0.10	0.10	0.10	0.10
Premix	5.0	5.0	5.0	5.0
Salt	1.64	1.63	1.90	1.05
Sodiumbicarbonate	3.10	2.15	2.05	2.03
Monocal	11.34	9.98	4.25	3.06
Lime	14.78	15.25	10.95	11.36
DL-Methionine 99%	2.58	2.36	2.44	1.74
L-Lysine HCl 98.5%	2.85	1.23	1.86	1.65
L-Threonine 98%	0.84	0.44	0.80	0.47
Chemical composition				
Crude protein	227	225	200	200
Crude fat	65	65	100	94
Crude fibre	28.6	28.5	28.6	27.8
Starch	371	373	368	375
Calcium (Ca)	9.60	9.68	6.80	6.80
Phosphorus (P)	6.37	6.32	4.73	4.65
Available P	4.40	4.40	3.09	3.09
Metabolisable energy (ME, kcal)	2850	2854	3000	3000
Dig. Lysine	11.60	11.60	10.30	10.30
Dig. Methionine	5.70	5.70	4.89	4.70
Dig. Methionine + Cystine	8.69	9.26	7.50	7.96
Dig. Tryptophan	2.09	2.34	2.00	2.04
Dig. Threonine	7.70	7.70	6.70	6.70
Dig. Isoleucine	8.14	8.53	7.10	7.36
Dig. Valine	8.90	9.43	7.75	8.28
Sodium (Na)	1.60	1.60	1.50	1.50
Potassium (K)	8.76	9.01	8.88	8.45
Chloride (Cl)	2.00	2.00	2.00	2.00
C14:0			0.62	0.54
C16:0			27.03	27.00
C18:0			3.65	3.63
C18:1			28.69	30.72
C18:2	23.99	21.02	27.79	20.31
Fytase (FTU/kg)	500	500	500	500

Measurements
Birds were weighed individually on day of arrival and subsequently on days 8, 15, 22, 29 and 36. Feed intake was measured per cage on a weekly basis. Feed intake per broiler was calculated as feed intake per cage divided by number of broiler days. Mortality was registered on a daily basis, but rates were only calculated for the total period.

Statistical analysis
All data for each variable were subjected to an one-way analysis, followed by a LSMeans Contrast test in which the dietary treatment was the independent factor with the statistical program SPSS. The level of statistical significance for contrasts was set at $P < 0.05$. This was carried out when the statistical level of the model was $P < 0.1$.

2 Results

2.1 Body weight and growth rate

The average body weight of the broilers at the start of the experiment (day 1) and at days 8, 15, 22, 29 and 36 are given in Table 2. At the end of the starter period, the broilers from both treatment groups receiving egg powder enriched diets (treatments B and C) were heavier than the broilers from the control group.
In the first week of the grower period, broilers receiving the control diet after being fed with the egg powder diet in the starter period (treatment C) were significantly heavier than animals still receiving the egg powder diet (treatment B).
Body weights at the end of the trial were still numerically higher for both groups receiving egg powder in the starter period than for control animals, although not statistically significant.

Table 2: Average body weight (g) of the broilers in the three dietary treatment groups.

	Treatment A *Control/Control*	*Treatment B* *Egg powder/Egg powder*	*Treatment C* *Egg powder/Control*	*Significance* *P-value*
Starter period				
Day 1	45.8	46.0	46.5	0.510
Day 8	169.8[a]	175.6[a]	181.8[b]	0.004
Day 15	466.8[a]	490.2[b]	498.8[b]	0.001
Grower period				
Day 22	910.6[a]	945.6[b]	960.8[c]	0.002
Day 29	1,467.5[a]	1,506.7[ab]	1,532.7[b]	0.021
Day 36	2,084.0	2,126.1	2,145.2	0.336

In the starter period, growth rates (g/d) of the birds of both treatment groups were significantly higher than for the control broilers (table 3). In the grower period, growth rates were not significantly different between the three treatment groups. Over the whole experimental period (week 1 – 5), growth rates of the broilers of treatments B and C were slightly higher than that of the control animals.

Table 3: Average growth rate (g/d) of the broilers in the three dietary treatment groups.

	Treatment A *Control/Control*	*Treatment B* *Egg powder/Egg powder*	*Treatment C* *Egg powder/Control*	*Significance* *P-value*
Starter period Week 1 + 2	30.1	31.7	32.3	0.001
Grower period Week 3 + 4 + 5	77.2	79.1	78.6	0.412
Total period Week 1 – 5	58.1	60.1	60.2	0.058

Feed intakes (g/d) of the broilers in the starter period, the grower period and the whole experimental period are given in table 4. There were no significant differences in feed intake between groups in any of the periods.

Table 4: Calculated daily feed intake (g) per broiler in the three treatment groups.

	Treatment A *Control/Control*	*Treatment B* *Egg powder/Egg powder*	*Treatment C* *Egg powder/Control*	*Significance* *P-value*
Starter period Week 1 + 2	37.8	38.2	39.0	0.557
Grower period Week 3 + 4 + 5	126.2	127.8	129.8	0.244
Total period Week 1 – 5	82.0	83.0	84.4	0.206

In the starter period, both groups receiving the egg powder diet had a significantly better feed conversion than the control group (table 5). In the grower period there were no significant differences in feed conversion between the three experimental groups, although the feed conversion of the broilers of treatment B (egg powder in both the starter and the grower period), was numerically better.

Calculated over the whole period, feed conversion of the group receiving egg powder in the starter as well as the grower period, was, although not significant, numerically better than of the control group. The group receiving egg powder only in the starter period was intermediate.

Although the growth rate, when calculated over the whole period, was not different between the treatments B and C, small differences in feed intake resulted in a numerically better feed conversion of 0.02 for the group receiving egg powder also in the grower period.

Table 5: Feed conversion of broilers in two different dietary treatment groups.

	Treatment A *Control/Control*	*Treatment B* *Egg powder/Egg powder*	*Treatment C* *Egg powder/Control*	*Significance* *P-value*
Starter period Week 1 + 2	1.26[a]	1.21[b]	1.21[b]	0.044
Grower period Week 3 + 4 + 5	1.64	1.62	1.65	0.357
Total period Week 1 – 5	1.56	1.53	1.55	0.122

The average water intake (g/d) per broiler, measured in different periods, is given in table 6. Although differences in water intake between treatment groups were statistically significant for all but the last measurement period, the differences between the groups were not consistent and not related to diet composition. It is therefore difficult to explain these differences.

Table 6: Average water intake (g/d) per broiler in two different dietary treatment groups.

	Treatment A *Control/Control*	*Treatment B* *Egg powder/Egg powder*	*Treatment C* *Egg powder/Control*	*Significance* *P-value*
Day 1-7	52.1	49.3	53.6	0.069
Day 11-14	121.5	128.4	132.5	0.002
Day 16-18	156.1	156.3	165.2	0.013
Day 24-26	207.2	189.3	200.6	0.025
Day 31-33	191.8	185.3	198.0	0.138

In both treatment groups B and C none of the broilers died during the experiment. In the control group, 4 animals died before the end of the experiment (4.17%). As a result, the calculated number of broiler days per cage was lower for the control group than for both treatment groups. Because only in one group a few animals died during the experiment no statistically based conclusions can be drawn on dietary effects.

Table 7: Mortality and number of broiler days in two different dietary treatment groups.

	Treatment A *Control/Control*	*Treatment B* *Egg powder/Egg powder*	*Treatment C* *Egg powder/Control*
Mortality (%)	4.17	0	0
Broiler days/cage	235	238	238

3 Economical Evaluation

Addition of 5% egg powder to the diets resulted in an increased cost price of 0.031 €/kg for the starter diet and 0.035 €/kg for the grower diet (based on an egg powder price of 1.51 €/kg). Based on these differences an economical evaluation was made. The results of these calculations are given in table 8.
The differences in feed costs are based on the feed intakes per bird and the differences in ingredients prices between the diets. This resulted in an increased production cost of 0.124 € per bird for treatment B and 0.048 € per bird for treatment C. Due to the higher weights of the animals fed the egg powder enriched diets, also the proceeds will be higher. These calculations were based on the NOP market prices published on July 24, 2008.
The calculations showed that, with the current prices, profits increase (1.2 eurocent/bird) with an addition of 5% egg powder to the broiler starter diet.

Table 8. Economical evaluation based on feed ingredient costs and broiler market prices on July 24, 2008.

		Treatment A Control/Control	*Treatment B Egg powder/Egg powder*	*Treatment C Egg powder/Control*
Feed intake (g/bird)	Starter period	529	535	546
	Grower period	2650	2684	2726
Increased feed cost (relative to control, eurocent/bird)	Starter period	--	+ 1.9	+ 2.3
	Grower period	--	+ 10.5	+ 2.5
	Total period	--	+ 12.4	+ 4.8
Weight of birds (kg)		2.084	2.126	2.146
Proceeds* (€/bird)		1.94	1.98	2.00
Profit difference (eurocent/bird)		--	- 8.4	+ 1.2

* Proceeds are based on a price of 0.93 €/ kg live weight, given by NOP 24-07-2008. Mortality differences are not included in the calculation.

4 Conclusions

- addition of 5% egg powder to the starter diet for broilers resulted in (treatments B and C versus treatment A):
    - higher growth rate
    - heavier animals at the end of the starter period
    - no effect on feed intake resulting in a better feed conversion of 0.04 compared to the control diet

- addition of 5% egg powder to a grower diet as well as a starter diet for broilers resulted in (treatment B versus C):
    - no extra effects on growth rate during the grower period
    - no differences in growth rate calculated over the whole period
    - numerically lower (not significant) feed intake during the grower period
    - slightly better feed conversion during the grower period, resulting in a numerically better feed conversion of 0.02 over the whole period

- economical evaluation showed that, based on the current prices, addition of 5% egg powder to the starter diet will result in higher profits of 0.012 €/bird. This effect is without taking differences in mortality into account.