Efficacy of a nucleotide preparation in broiler chickens

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Availability of nucleotides may limit performance in fast growing animals. An experiment was conducted to determine the efficacy of a nucleotide preparation (Nucleoforce Poultry) in broiler chickens. Nine hundred and sixty day-old broiler chickens were allocated into 24 pens, and assigned one of 3 treatments: 0, 500 and 1000 mg of the nucleotide preparation/kg feed. Feeds were based on wheat, barley and soybean meal. The starter diet, till 21 days contained 21.5 % protein, the grower diet till 39 days 20 % protein, and the withdrawal diet 18 % protein. Performance was determined at 21 and at 42 days. Results were analyzed as a randomized complete block design. At 21 days, the nucleotide preparation at 500 mg/kg feed significantly improved body weight by 1 % and by 1.9 % feed to gain ratio, while at 1000 mg/kg there was no significant effect. There were no significant effects between 21 and 42 days but body weight and feed to gain ratio were numerically better in the treatments containing nucleotides. In the overall experiment, the nucleotides at 500 mg/kg significantly improved feed to gain ratio. Results suggest that the nucleotide preparation at 500 mg/kg significantly improves the performance of broiler chickens.

Keywords: broilers, nucleotides, daily gain, feed to gain ratio

Introduction

Nucleotides are normal components of the diet and the body provides mechanisms for their absorption and incorporation into tissues (Sanchez-Pozo & Gil, 2002). However, during periods of intensive development, nucleotide availability could limit the maturation of fast dividing tissues with low biosynthetic capacity, such as the intestine (Leleiko et al, 1983; Van Buren & Rudolph, 1997).

In chickens, dramatic changes occur in the development of the small intestinal mucosa after hatching, including enterocyte maturation, intensive cryptogenesis and villous growth (Geyra et al, 2001). This intestinal development influences the growth rate, since intestinal maturation plays a rate determining role in providing the substrates for growth (Smith et al, 1990).

Nucleotide supplementation has been demonstrated to accelerate intestinal maturation both in humans (Sanchez-Pozo & Gil, 2002) and pigs (Martinez-Puig et al, 2007), but to date no information is available on chickens. The aim of the present experiment was to study the effect of nucleotide supplementation on productive performance of broiler chickens.

Materials and methods

Nine hundred and sixty day-old broiler chickens of the Ross 308 strain were allocated by sex into 24 pens, at 40 males or 40 females per pen and assigned one of three treatments which consisted of three levels of supplementation of the nucleotide preparation (Nucleoforce®) in the diet: 0, 500 and 1000 mg/kg feed. Feeds were based on wheat, barley and soybean meal. Composition of the basal diets is shown in Table 1. The feeding program consisted of a starter diet till 21 days, based on wheat, barley and soybean meal, containing 3000 kcal ME/kg feed and 21.5 % protein, a grower diet till 39 days, containing 3100 kcal ME/kg feed and 20 % protein, and a finisher diet without coccidiostats containing 3150 kcal ME/kg feed and 18 % protein. Chickens and feed were weighted at 21 and at the end of the experiment at 42 days. Performance was determined for each period and for the overall experiment. The experiment was designed as a randomized complete block design with 8 blocks, corresponding to sex and location within the house and 3 dietary treatments. Sex was included in the block effect. Treatment means were compared by Duncan's multiple range test.

Results and discussion

Performance during the experiment is shown in Table 1.

Table 1. Performance during the experiment.

	T-1 Negative control	T-2 Nucleotides 500 mg/kg	T-3 Nucleotides 1000 mg/kg	*Pooled* *Standard error*
Bodyweight at 21 days (g)	940[1]	949	931	*6.8*
Body weight at 42 days (g)	2798	2844	2828	*62.6*
Daily gain 1 to 21 days (g/d)	42.6	43.0	42.2	*0.91*
Daily gain 21 to 42 days (g/d)	88.5	90.2	90.3	*2.54*
Daily gain 1 to 42 days (g/d)	65.6	66.6	66.3	*1.49*
Daily feed 1 to 21 days (g/d)	56.0a	55.5	55.2	*1.03*
Daily feed 21 to 42 days (g/d)	175.4	174.8	175.1	*4.48*
Daily feed 1 to 42 days (g/d)	115.5	115.1	115	*2.6*
Feed/ gain 1 to 21 days (g/g)	1.316a	1.292b	1.309a	*0.0124*
Feed/ gain 21 to 42 days (g/g)	1.987	1.942	1.94	*0.0435*
Feed/ gain 1 to 42 days (g/g)	1.765a	1.730b	1.737ab	*0.0276*

Mortality 1 to 21 days (%)	0.6	1.5	1.49	*1.784*
Mortality 21 to 42 days (%)	1.58	0.65	0.31	*1.459*
Mortality 1 to 42 days (%)	2.10	2.10	1.78	*2.387*

[1]Values are means of 4 replicates of 40 males and 4 replicates of 40 females per treatment. Means followed by different letters are significantly different, $P < 0.05$ (Duncan's multiple range test).
NS = $P > 0.1$; (*) = $P < 0.1$; *= $P < 0.05$; ** = $P < 0.01$

During the first 21 days, chickens receiving 500 mg of the nucleotide preparation/kg feed had a lower feed to gain ratio ($P < 0.05$) than those of the other treatments. The difference was 1.9 % in feed to gain ratio, with respect to the negative control. There was no effect of the 1000 mg/kg level, suggesting that this level does not cause any positive effect on performance, possibly because the cost of disposal of excess nucleotides compensates the improvement in performance. There were no significant differences during the 21 to 42 period for any of the parameters examined ($P > 0.1$). In the overall experiment although differences did not reach the $P < 0.05$ level, chickens receiving 500 mg Nucleoforce/kg feed were 1.6 % heavier than those of the negative control and this difference was significant at the $P < 0.08$ level. Feed to gain showed a significant difference of 2 % in the chickens between the negative control and the 500 mg/kg level.

Results suggest that the more significant effects observed in the first 3 weeks reflect the greater need for nucleotides during this period of fast cell proliferation, as the chicken multiplies its initial body weight by a factor of more than 20, and also suggests that availability of nucleotides limits performance during this period. These results are in agreement with Tipa (2002) who showed that broiler chicks fed diets containing nucleotides from yeast extracts, had higher average live body weight, body weight gain and better feed conversion from the first to the fourth week of life. However in other trials (Owens & McCracken, 2007; Deng et al 2005) no clear effects of nucleotide supplementation on productive performance have been observed. Differences among trials could be related to the content of available nucleotides of the different supplements. In some trials yeast RNA is used as a nucleotide source; however availability of RNA nucleotides could be compromised by the relative immature enzymatic system of the post-hatched chick intestine.

In our experimental trial, the lack of positive effect of the high level during the first 3 weeks could suggest that the cost of disposal of excess nucleotides may compensate the improvement in performance. However, this effect is not observed in the last 3 weeks, suggesting that chickens may need some adaptation to utilize a higher levels of nucleotides.

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