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Technical Information

Effect of protein and energy level in feed on posthatch chick performance

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Broiler chicks increase their body weight approximately 50-fold within 40 days of age. Because of this short life cycle, growth during the first week is important. This is also reflected in the positive relation between body weights in the first week and body weights at marketing (Nir and Levanon, 1993; Gonzales et al., 2003).

To start development of the bird posthatch, early feed is important, as is emphasized in different studies (Noy and Sklan 1999; Batal and Parsons, 2002; Uni and Ferket, 2004). The posthatch bird is anatomically complete, but digestive, immune and thermo-regulatory systems still need to develop (Maiorka et al., 2006). Besides utilization of exogenous feed, the residual yolk of chicks is also utilized during the first days posthatch (Romanoff, 1960; Noy and Sklan, 2001). Diet composition may interact with this utilization of yolk. The physiological conditions of posthatch chicks is in comparison to older chicks different and this might contribute to a difference in nutritional requirements. Optimal feed formulations for specifically the first days posthatch of broiler chickens are less known. Feed formulations are often based on average requirements for a longer period, and therefore not necessarily optimal for the first days posthatch.

This study was performed to gain more insight in the nutritional requirements of birds in the first days after hatch. This study evaluates the effect of protein and energy level on body weight and feed intake of chicks till 4 days posthatch.

Material & Methods

A total of 400 chicks originating from a broiler breeder flock of 48 weeks of age were used for this experiment. Hatched and dry chicks were taken from the incubator at day 20 of incubation, one day earlier than normal procedure. The age of these birds is expressed in the results of this study as day – 1. Chicks were randomly assigned to 4 diets, with 5 replications for each treatment. Diets were: A. High digestible lysine (12.5 g/kg), high energy (2950 kcal AMEN); B. High digestible lysine (12.5 g/kg), low energy (2800 kcal AMEN) C. Low digestible lysine (10.8 g/kg), high energy (2950 kcal AMEN) D. Low digestible lysine (10.8 g/kg); low energy (2800 kcal AMEN). Lysine amounts of the diets are expressed as apparent fecal digestible (AFD) lysine/kg. The ratio's between Lysine and all other indispensable amino acids (Met+Cys, Thr, Trp, Ile, Val en Arg) were kept the same in all diets. The energy contents of the diets are calculated based on the energy formulas for broilers of the CVB Livestock Feed Table (2001). Feed and water were available ad libitum throughout the experiment. Birds were kept in a brooding system to maintain rectal body temperatures around 40.6°C.

Body weight and feed intake were measured daily until 4 days posthatch. Data were analyzed or differences using the GLM procedure of SAS (version 9.1, 2002). The threshold for significance was $P<0.05$.

Results and discussion

At day 4 posthatch, chicks fed diet B had significant higher body weights than chick fed diet C and D (Figure 1; $P<0.05$). Chicks fed diet B showed a tendency to a higher body weight at day 4 posthatch than chicks fed diet A (Figure 1; $P<0.10$).

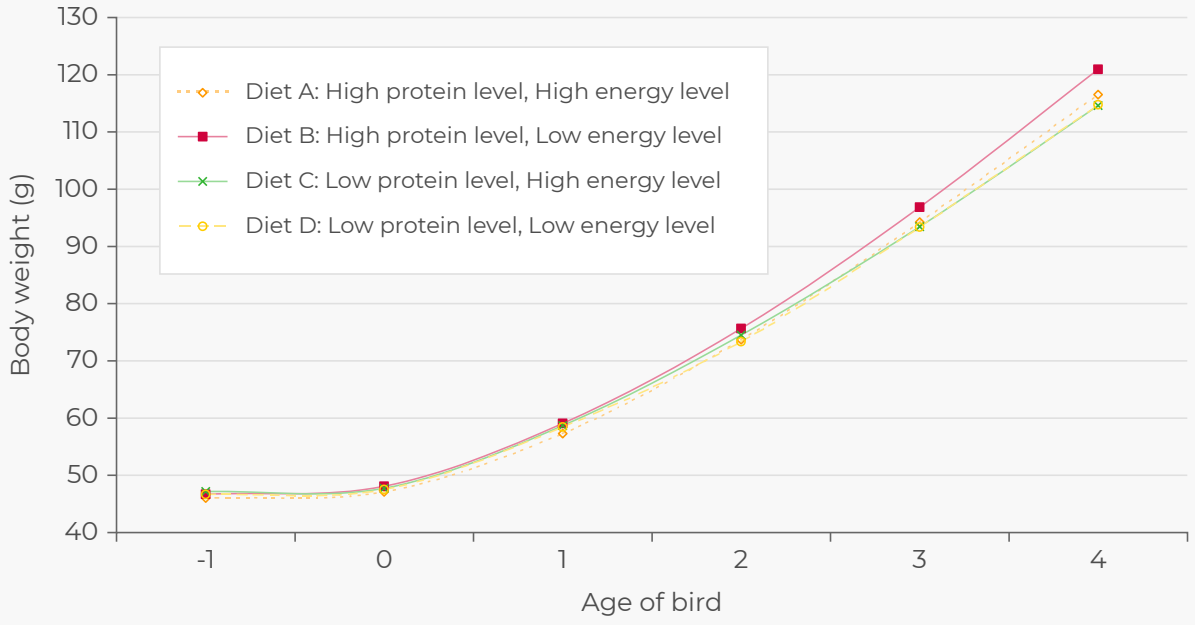

Figure 1: *Effect of different protein and energy levels on body weights of posthatch chicks. Hatched chicks were taken from the incubator at day 20 of incubation*

High protein levels in combination with low energy levels in the diet showed a positive effect on posthatch growth. Other studies showed as well that body weight gain during the first weeks increased with increasing protein levels in a balanced amino acid composition of the diet (Sklan and Noy, 2003; Wijtten et al., 2004). Chicks might have a high protein requirement for the development of specific tissues posthatch. Especially the small intestines grow rapidly in the posthatch period (Nitsan, 1991; Sklan 2001).

In this study, high energy levels did not result in a higher growth posthatch, which might be due to the immaturity of the digestive tract. Intestinal mucosa, crypth depth and villus height need to develop in time (Uni et al., 1998; Yi et al., 2005) as well as enzyme secretions like lipase, trypsin and amylase (Nitsan et al., 1991; Sklan and Noy, 2000). Bile salt and lipase secretions might be limiting factors for fat absorption in the posthatch period (Krogdal and Sell, 1989) and this might indicate that the digestive tract is not capable yet to utilize high energy levels in the posthatch period. This is confirmed by Noy and Sklan (2002), who found that the absorption of an unsaturated fatty acid, oleic acid, by itself is high in posthatch chicks, but an increased intake of this lipid depressed the percentage of absorption.

Feed intake was not influenced by diet composition (Figure 2; $P>0.05$). This indicates that regulation of feed intake by energy or protein intake in chicks is limited until four days of age. Studies, that balanced amino acid compositions of the diets, found as well that feed intake in the first 2 weeks was not regulated by protein level (Morris and Abebe, 1990; Wijtten et al., 2004). Other studies found that feed intake was influenced by energy density in the feed (Noy and Sklan, 2002; Plavnik et al., 1997), but in these studies the effect was studied over a longer period of time than just the first days posthatch.

Factors like pellet size, hardness and palatability might play an important role to induce a quick and an easy ingestion of feed.

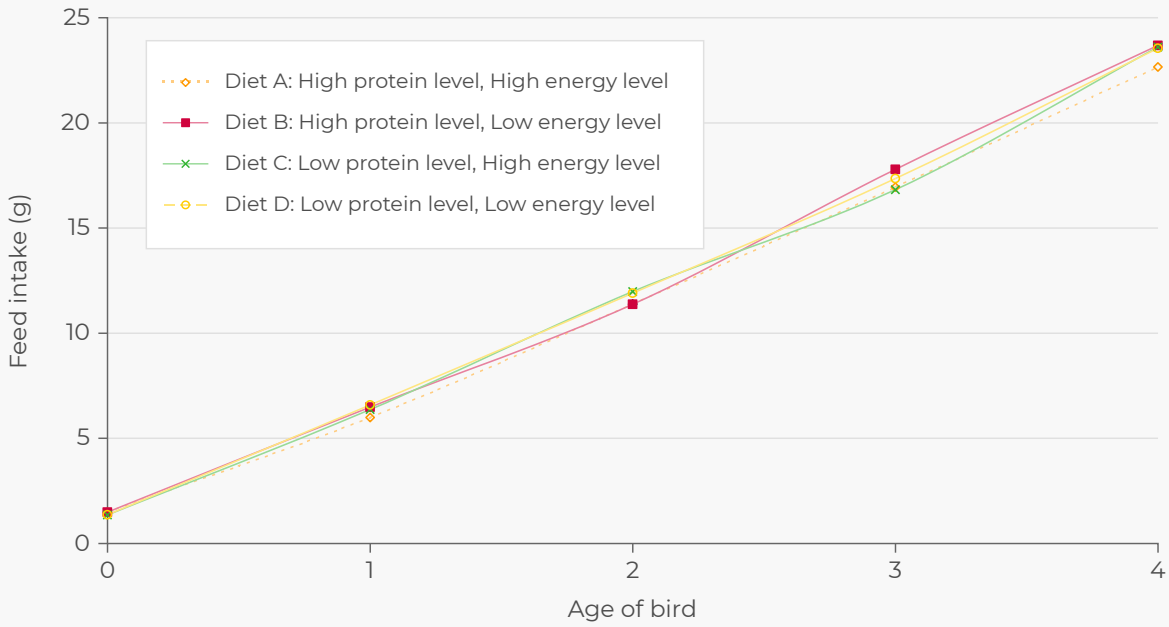

Figure 2: *Effect of different protein and energy levels on feed intake of posthatch chicks*

Feed intake in posthatch chicks might be related to environmental temperature as well. Chicks do not have a fully developed thermoregulatory system in the posthatch period (Nichelmann and Tzschentke, 2002) and sub-optimal temperatures might influence feed intake and posthatch growth. To exclude the influence of sub-optimal environmental temperature in this experiment, birds were kept in a brooding system and rectal temperatures were maintained at 40.6°C.

During the first day (day –1 to 0) there was no significant weight gain observed in all treatments. However, individual birds either gained or lost weight in the first day. When analysing bodyweight gain of all birds, a negative correlation (r= -0.29; ß=-0.33 g/g; P<0.05; Figure 3) was found between bodyweight at hatch and bodyweight gain during the first day. No differences between treatments were observed. A possible explanation could be that birds after clearing the eggshell do not start to eat immediately but only after a delay in time. During this delay, birds will lose body weight mainly as a result of moisture loss.

Chicks that were heavier at the onset of the experiment, might have hatched later and did not lose as much moisture as the lighter chicks. Chicks that might have hatched later may need more time to start eating and growing. Chicks that hatched early were lighter at the start of the experiment and may have start eating and growing faster. This might have resulted in a negative correlation between early body weight and early weight gain. The relation between hatch time and the onset of feed intake was not a factor in this experiment, but might be of interest.

In conclusion, the results of this study showed that a diet with high protein and low energy levels is beneficial for posthatch growth. Feed intake was not influenced by diet composition in the posthatch period, but the start of feed intake might be influenced by body weight and/ or hatching time.

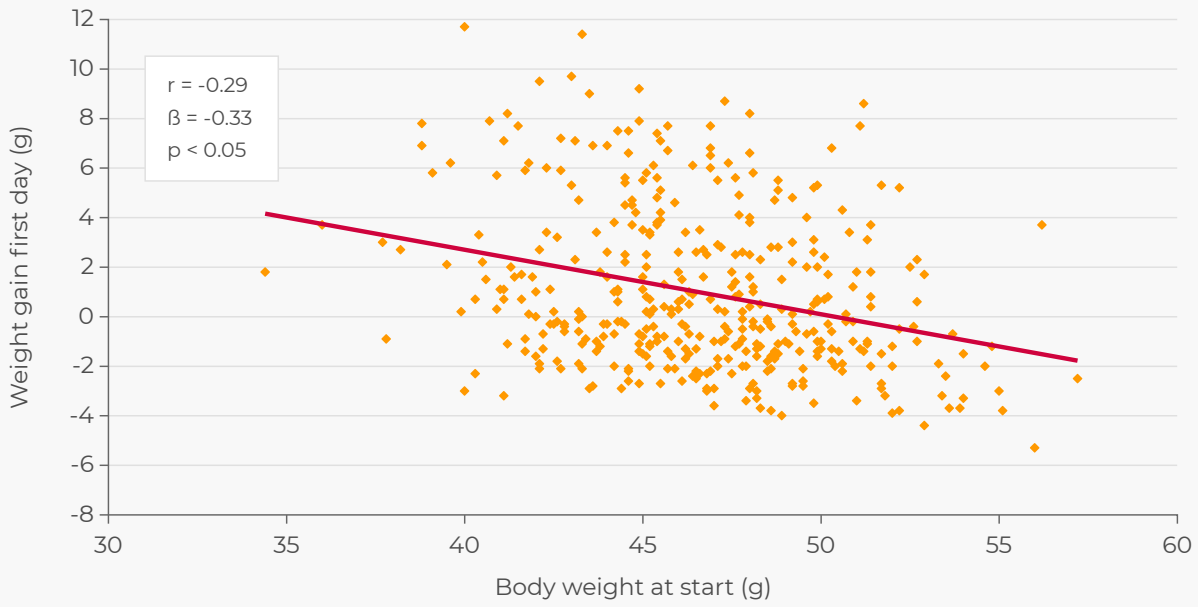

Figure 3: *Relation between body weight of chicks at start of the experiment and weight gain the first day*

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