Ileal apparent digestibility of nutrients in chickens at 7 and 21 days of life under feeding differed in protein level mixtures

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Abstract

The aim of the study was the determination of apparent ileal digestibility of nutrients in chickens fed diets differed in crude protein level with or without amino acids supplementation. Clearly increase tendency of CP digestibility between groups from I to III was observed only in one-week old chickens. In both age the increase digestibility of AA according to depressed CP content in diets was estimated for Pro, Ala and simultaneously decrease coefficient for Thr, Gly, Arg, Ile, Leu.

Introduction

Feeding of young broiler chickens with diets reduced at protein level without or with balanced exogenous amino acids can modify the early growth and some physiological parameters of birds and simultaneous may allow to obtain similar final production effect in broilers as with standard diets (Wertelecki et al., 2001; Stringhini et al., 2002; Koreleski et al., 2001).

In present study the chickens fed prestarter and starter diets containing different levels of crude protein and amino acids. The apparent ileal nutrients digestibility has been determined. This information is important for correction of early chicks feeding.

Materials and Methods

The 420 male Hubbard chickens at age 0-21 days of life were used in whole experiment, to the digestibility trial in 7th and 21st days of life 240 chickens were chosen (40 birds per group in each period). One-day old chicks with average body weight of 38.8 g (±1.5 g) were randomly divided into three dietary treatments (group I – III), with ten-subgroups (cages) with 14 birds/cage. The chickens were kept in battery cages. The experimental diets as prestarter (fed between 1-7 days of life) and starter (fed between 8-21 days of life) were based on: maize (53-62%), soyabean meal Glycine max 47.5% CP (30-40%), soya oil (3.2-5.0%), minerals and premix (without feed antibiotica, enzymes, amino acids) and containing different energy :crude protein ratio without amino acids supplement in prestarter formulas or with four exogennous amino acids supplement in starter mixtures as: Lys (L-HCl 78%, from 0.2-0.3%), Met (DL 99%, 0.17-0.21%), Tre (L 98%, 0.17-0.3%) and Try (L 98%, 0.04-0.06%) to level applied in diet I group (according to Hubbard Isa recommendation) (Tab. 1). The apparent ileal digestibility of crude protein (CP), crude fat (EE), N-free extract (NFE) and amino acids (AA) was estimated in chickens fed diets containing 0.5 % of chromium oxide (Cr_2O_3) as marker at the period of 1-7 and 14-21 days of age. On 7th (prestarter) and 21st (starter) days of age, 4 animals per cage were slaughtered and at once the intestinal contents (from the Meckel' diverticulum to the conjunction with the caecum and large intestine) were collected. In the fresh ileal content, dry matter and other nutrients were determined using standard methods AOAC (1990). The chromium was determined according to Fenton and Fenton (1979).

Table1. Composition and nutrients content in experimental mixtures

Item		Prestarter mixtures			Starter mixtures		
		I	II	III	I	II	III
Crude protein	g 100g^{-1}	22.1	20.0	18.5	22.1	19.9	18.5
Ratio EM:CP	kcal/CP%	136.3	150.1	162.8	135.7	150.7	162.2
Lys	g 100g^{-1}	1.30	1.14	1.04	1.30	1.30	1.30
Met +Cys		0.78	0.73	0.69	0.94	0.92	0.90

Thr	0.69	0.62	0.57	0.86	0.86	0.86
Try	0.31	0.27	0.24	0.31	0.31	0.30
Val	0.70	0.63	0.58	0.70	0.63	0.58
His	0.54	0.49	0.45	0.54	0.49	0.45
Iso	0.63	0.57	0.53	0.63	0.57	0.53
Leu	1.60	1.50	1.44	1.59	1.50	1.43
Phe+Tyr	1.36	1.23	1.14	1.36	1.23	1.14
Arg	1.10	0.99	0.91	1.10	0.99	0.91

Results and Discussion

The differed body weight of chickens between groups were observed in both periods. Reduction of crude protein level to 185 gkg^{-1} in feeds significantly decreased body weight (group III) of broilers ($P<0.05$) (Tab. 2). Similar results was observed in earlier realized investigations by Wertelecki et al. (2004) and other authors Kidd et al. (1998), Stringhini et al. (2002). The feed intake was significantly differenced only from 1st to 7th days, the highest value was estimated in group II and lower in I (total different 6,6g/head). The higher feed intake in group II was correspondence with greater body weight at 7th day. The growth in first week of life must consider yolk sac utilization and this could improved the feed consumption and the other side, performance (Noy et al., 2002). Between 8th to 21st days with reduction level of crude protein in diets the feed intake was depressed. Similar results for feed intake was presented in studies of Stringhini et al. (2002).

Table 2. Main results of experiment, performance and apparent ileal digestibility of nutrients

Item	Prestarter – 7 days of life			Starter – 21 days of life		
	I	II	III	I	II	III
Mean body weight in g	105.99a	108.19a	103.20b	560.56a	566.25a	551.95b
Feed intake in periods* g/h	83.01a	89.59b	86.00ab	665.12	660.34	653.67
Digestibility of nutrients %:						
CP	76.70ab	73.59a	78.49b	84.14	84.22	84.78
EE	76.81a	71.63ab	64.56b	92.48a	90.96ab	88.20b
NFE	65.71ab	60.31a	69.72b	71.81a	73.94b	74.17b
Asp. a.	74.90	70.07	75.75	81.88	80.62	80.98
Thr	63.81a	61.15ab	58.92b	81.68	81.21	80.10
Ser	71.90	69.13	69.70	78.97	79.62	80.16
Glut. a.	86.16	83.27	85.32	90.56	90.38	91.49
Pro	72.59a	73.84a	78.50b	82.13	84.13	83.90
Cys	58.01ab	54.26b	66.87b	82.68a	73.99b	73.43b
Gly	69.31	65.38	67.45	84.05a	82.62ab	80.21b
Ala	75.55	78.07	77.47	83.82	84.02	84.04
Val	83.83c	69.94a	76.30b	84.48	86.10	86.25
Met	81.23	74.98	81.37	93.03	92.31	91.19
Ile	82.47a	77.09b	78.15b	86.45	84.54	85.21
Leu	78.15	76.48	78.04	88.57	85.95	87.07
Tyr	76.46b	50.57a	78.95b	85.13a	87.18ab	89.34b
Phe	78.74	78.99	78.62	86.04	86.74	86.48
His	77.73a	69.80b	72.10ab	83.84	84.33	82.53
Lys	84.03a	79.73b	80.84ab	87.34a	87.85a	90.80b
Arg	84.76	84.17	84.39	90.64a	87.77b	86.70b
Try	79.80	79.61	80.92	85.90	86.27	83.15

* 1-7 days; 8-21 days of life; $P<0.05$ - a, b, c significantly differences

The higher ileal digestibility of CP was observed in group III in comparison to I and II group only in 7th day ($P<0.05$). With reduction of protein content in diets the digestibility of EE was depressed, but simultaneously digestibility of NFE increased in both analyzed periods. Possibility, the changes of digestion coefficients for EE and NFE was dependent of chemical composition of diets, for example the concentration of starch was increased from 340 to 400 gkg^{-1} between group I to III. For young bird the starch is a better energy source then fats. These results was similar to studies presented by Moran (1982) and Parson (2004).

The changes in amino acids apparent ileal digestibility was dependent of age and treatments. For example at 7th day of life the decrease tendency of amino acids digestibility with depressed content of crude protein in diets were observed for Thr, Ser, Glut.a., Gly, Val, Ile, His and Lys but simultaneously only Asp.a., Pro, Cys, Ala digestion was increased at this age. In 21st days old birds ileal digestibility of AA was changed then first week.. Decrease coefficients of digestion according to reduced level of CP in diets were confirmed for Asp.a., Thr, Cys, Gly, Met, Leu and Arg. The better digestibility of Ser, Glut.a, Pro, Ala, Val, Tyr, Phe and Lys were estimated in group II or III then group I in that same age of birds. The increase of Lys digestion at 21st day of life between groups was dependent of pure L-lysine supplement to mixtures. For others supplemented to starter diets exogennous amino acids as Met, Thr, Try this tendency was not confirmed. The similar changes of AA digestibility according to treatments – reduced CP level in diets and age of chickens was presented in earlier studies by Wertelecki et al. (2004), Stringhini et al. (2002).

The reduced level of CP in diets selectively influenced the digestibility of nutrients in dependency with age of birds. Clearly increase tendency of CP digestibility between groups from I to III was observed only in one-week old chickens. In both age the increase digestibility of AA according to depressed CP content in diets was estimated for Pro, Ala and simultaneously decrease coefficient for Thr, Gly, Arg, Ile, Leu.

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