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The effect of various levels of dietary protein based on total and digestible amino acids on performance of Ross 308 broilers

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Abstract

This experiment was carried out on 288 broilers from Ross 308 strain with the same initial weight in six treatments. Each treatment had three replicates with eight males and eight females in each replicate in a period of 42 days. The metabolic energy was considered constant in this experiment. The used diets contained low, average and high levels of protein with digestible and total amino acids according to the suggested pattern of Ross 308 broiler strain catalogue. The treatments include T1: Low level of protein with DAA, T2: Average level of protein with DAA T3: High level of protein with DAA, T4: Low level of protein with TAA, T5: Average level of protein with TAA, T6: High level of protein with TAA. During each period of experiment, the characteristics of weight gain, feed intake, feed conversion ratio and production index were measured. Weight gain in finisher and total period was significantly high in T2 group. However, mean feed intake was significantly high in T2 group. Production index was significantly high in T5 in finisher stage while significantly low in T4 in total period. It can be concluded that diets with different levels of protein along with digestible amino acids perform better in production index and parameters consisting of feed intake, feed conversion and weight gain than diets with different levels of protein and total amino acids.

Keywords: Protein; digestible and total amino acids; performance; production index; Ross 308 broiler strain

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Introduction

Nowadays chicken meat production is no more a by-product of the egg industry and is performing independently to meet the human protein needs. One of the important issues in this industry is the feed cost which usually ranges between 65 and 75% of the total production cost (Haq and Akhtar, 2004). Hence, it is necessary to provide low cost and good quality ingredients for poultry rations.

Protein is an important component of food that generates a lot of interest and challenges to nutritionists (Dairo et al., 2010). The vegeTable proteins are the major protein source in poultry feed. Their inclusion to poultry feed is 28% and accounts for about 33.5% of the total feed cost in commercial poultry (Sarwar et al., 2002). Thus, it is important to know which level of dietary protein is suiTable for broiler performance. Some researchers have shown that reduced crude protein (CP) amino acid supplemented diets support good growth, more weight gain and feed consumption of broilers (Deschepper and De Groote, 1995; Yamazaki et al., 1996; Aletor et al., 2000, Berres et al., 2010; Khan et al., 2011; Manoochehri Ardekeni and Chamani, 2012), while others demonstrated negative effects of low crude protein-amino acid supplemented diets on broiler productivity (Edmonds et al., 1985; Fancher and Jensen, 1989; Holsheimer and Janssen, 1991; Jensen, 1991; Moran et al., 1992; Bregendahl et al., 2002). Lowering dietary protein levels, while reduce cost of diet, will reduce environmental pollution of nitrogen which is now one of the biggest problems in developed and developing countries (Aletor et al., 2000; Kamran et al., 2010).

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Over the past 50 years, genetic potential of broilers has been improved considerably which has consequently changed their nutrient and amino acid requirements (Gous, 2010). As a result, amino acid (AA) needs of the modern broiler are higher than AA minimums used for broilers in previous years. Formerly, the formulation of poultry diets was based on the total AA concentrations of feed ingredients and mix gender, frequently resulting in diets containing amino acid levels not suiTable to the real requirements of birds (Salehifar, 2012). However, formulating diets on digestible AA basis increases accuracy, minimizes nutrient excesses, and reduces costly safety margins, especially for ingredients that are variable in AA composition (Rostagno et al., 1995; Dari et al., 2005). For instance, Wang and Parsons (1998) reported birds fed diets containing 10 or 20% meat and bone meal MBM and formulated on a total AA basis showed reduced growth and efficiency compared with those fed corn-soybean meal diets. When diets were formulated on a digestible AA basis, performance of birds fed MBM-containing diets was similar to birds fed corn soybean-meal diets. Formulating diets based on digestible AA ratios allows AA requirements to be met without placing a minimum specification for CP (Emmert and Baker, 1997). It is also shown that diets that are reduced in CP and formulated with supplemental AA require less intact protein sources, ultimately lowering diet cost and reducing nitrogen excretion (Corzo et al., 2005). Thus, broiler diet formulation on a digestible basis can lead to substantial economic and environmental benefits (Rostagno et al., 1995; Dari et al., 2005). In the present study, we aim to compare effect of low, average and high levels of protein with digestible amino acid (DAA) and total amino acid (TAA) according to the suggested pattern of Ross 308 broiler strain catalogue on the performance of Ross 308 broilers.

Materials and Methods

This experiment was conducted at Agricultural and Research Farm (Karaj Branch, Islamic Azad University) on 288 one-day-old broilers from Ross 308 strain with the same initial weight (38±2g BW) in 6 treatments. Each treatment had 3 replicates and 16 broilers (8 males and 8 females) in each replicate in a period of 42 days. The diets used in this experiment contained low, average and high levels of protein with digestible and total amino acids according to the suggested pattern of Ross 308 broiler strain catalogue formulated by UFFDA software. The metabolic energy was considered constant in this experiment (3025 ME kcal/kg at starter, 3150 ME kcal/kg at grower and 3200 ME kcal/kg at finisher). Treatments were: T1: Low level of protein with DAA, T2: Average level of protein with DAA T3: High level of protein with DAA, T4: Low level of protein with TAA, T5: Average level of protein with TAA, T6: High level of protein with TAA. During each period of experiment, the characteristics of weight gain, feed intake, feed conversion ratio and production index were measured. At the end of the experiment, the cost of feed for one kilogram weight gain was calculated. Then the collected data were analyzed using the GLM procedure of SPSS 11.5 software and means were compared by Duncan procedure.

Results

Results in Table 1 indicate that there was no significant difference in weight gain at starter and grower between ratio means (P>0.05). Comparing weight gain means showed that T4 and T6 at starter had the highest and lowest weight gain respectively. Statistical analysis demonstrated that the experimental broilers had significant weight gain at finisher and total period (P<0.05). Mean comparison indicated that the difference in feed intake between treatments was

Table 1: Mean weight gain (gm) in different treatments

Ratio	Starter (0-10)	Grower (11-24)	Finisher (25-42)	Total (0-42)
T1	173.23	1145.78	1530.06^{ab}	2849.28^{c}
T2	178.07	1163.5	1663.34^{a}	3050.88^{a}
T3	182.53	1145.43	1549.49^{ab}	2930.48a^{b}
T4	201.4	1036.75	1448.29^{b}	2819.04^{c}
T5	187.9	1088.58	1637.50^{a}	2962.82^{ab}
T6	160.93	1165.84	1602.87^{ab}	2929.64b^{c}
SEM	9.444	24.341	20.770	13.89
P	0.872	0.61	0.099	0.006

Different letters in each column indicates difference between means at P<0.05

Low level of protein with DAA, T2: Average level of protein with DAA T3: High level of protein with DAA, T4: Low level of protein with TAA, T5: Average level of protein with TAA, T6: High level of protein with TAA.

Table 2: Mean feed intake (gm) in different treatments

Ratio	Starter (0-10)	Grower (11-24)	Finisher (25-42)	Total (0-42)
T1	260.2	1286.26	2909.15^{ab}	4455.5
T2	260.8	1329.60	3058.64^{a}	4733.96
T3	252.43	1260.78	2852.49^{ab}	4452.56
T4	264.53	1242.19	2750.54^{b}	4479.58
T5	261.37	1275.82	2872.49^{ab}	4484.06
T6	2588.73	1265.85	2999.2^{ab}	4523.68
SEM	2.558	14.505	32.565	41.297
P	0.83	0.63	0.17	0.4

Different letters in each column indicates difference between means at P<0.05

Low level of protein with DAA, T2: Average level of protein with DAA T3: High level of protein with DAA, T4: Low level of protein with TAA, T5: Average level of protein with TAA, T6: High level of protein with TAA.

Table 3: Mean feed conversion in different treatments

Ratio	Starter (0-10)	Grower (11-24)	Finisher (25-42)	Total (0-42)
T1	1.5	1.12	1.9	1.563
T2	1.46	1.14	1.84	1.55
T3	1.46	1.1	1.84	1.517
T4	1.36	1.2	1.9	1.587
T5	1.49	1.18	1.75	1.513
T6	1.6	1.08	1.87	1.547
SEM	0.064	0.026	0.022	0.012
P	0.927	0.735	0.47	0.498

Low level of protein with DAA, T2: Average level of protein with DAA T3: High level of protein with DAA, T4: Low level of protein with TAA, T5: Average level of protein with TAA, T6: High level of protein with TAA.

Table 4: Mean production index (percent) in different groups

Ratio	Starter (0-10)	Grower (11-24)	Finisher (25-42)	Total (0-42)
T1	141.66	711.06	794.33[ab]	390.72[ab]
T2	149.03	712.14	873.1[ab]	419.8[a]
T3	163.6	745.44	847.06[ab]	407.38[a]
T4	186.49	625.03	782.01[b]	362.1[b]
T5	171.91	662.8	897.77[a]	412.17[a]
T6	125	739.76	833.34[ab]	408.43[a]
SEM	15.364	21.388	12.852	4.547
P	0.877	0.573	0.15	0.034

Different letters in each column indicates difference between means at P<0.05

Low level of protein with DAA, T2: Average level of protein with DAA T3: High level of protein with DAA, T4: Low level of protein with TAA, T5: Average level of protein with TAA, T6: High level of protein with TAA

Table 5: Cost of food (Rial) per 1 kilogram weight gain in total period

Ratio	Aliment Expenses
T1	8783
T2	8883
T3	8923
T4	882
T5	8617
T6	9017
SEM	6.727
P	0.641

Rial: is the currency of Iran

significant at finisher (Table 2). Results presented in Table 3 showed no significant difference in feed conversion at all treatments (P>0.05). Results of production index of the experimental broilers are presented in Table 4. Results indicate that there was a significant difference between T4 and T5 in production index at finisher. The difference between treatments in production index was also significant at total period. Findings also showed that different protein levels with DAA and TAA had no effect on production index at starter and grower. T6 and T5 respectively had the highest and lowest food cost for 1 Kg during the whole period. However the differences were no significant (Table 5).

Discussion

Although ratios with different protein levels and amino acids did not change significantly the broilers weight at starter and grower phases, weight gain at finisher and total period was significantly noticeable. Moran and Stilborn (1996) and Farrell et al. (1999) stated that different protein levels had no effect on weight gain at starter and grower. Sterling et al. (2005) and Fangyan et al. (2000) reported significant increase in weight gain at finisher and total period. The feed intake of broilers at finisher phase was influenced by dietary protein level and the type of amino acid. Broilers fed with average level of protein with DAA had the highest feed intake. It was also found that increasing TAA protein level lead to increase in feed intake. This is in line with Fangyan et al. (2000) who found that decreasing dietary protein level at finisher phase reduced the feed intake. In the present experiment, changing protein level and amino acid type did not influence feed conversion in broilers at any phase. It was in agreement with the findings of some other researches (Jackson et al., 1989; Moran et al., 1992; Rostagno et al., 1995; Farrell et al., 1999; Cauwenberghe and Burnham, 2001; Dari et al., 2005). It was also found that production index at finisher and total period were affected by protein level and amino acid type. Rostagno et al. (1995) reported similar results. They suggested that formulating rations with DAA provided more accurate scale for determining protein quality and performance of broilers and increases economic benefits. Diet with average level of protein with TAA was the most cost effective ratio for one kilogram weight gain. However, feed costs of different rations were not significantly different. Corzo et al. (2010) also reported that different amino acid levels and types had no significant effect on weight gain. According to findings of Table 5, it is clear that difference between the highest and lowest food cost is 400 Rials which can be important for a breeding units in economic profitability. According to the results of this study, mentioned above, it can be concluded that diets with different levels of protein along with digestible amino acids perform better in production index and parameters consisting of feed intake, feed conversion and weight gain than diets with different levels of protein with total amino acids.

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