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Effects of Different Dietary Energy and Protein Ratios on Plasma Concentrations of Growth Hormone, Thyroxine and Triiodothyronine in Broilers

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Abstract: Different dietary energy intake affect on metabolic hormones in broilers. The goal of this study was to determine whether different dietary energy and protein ratios alter metabolic hormonal profile in broilers. Effect of a different dietary energy and protein ratios in broiler on plasma concentrations of growth hormone (GH). Thyroxine (T4) and triiodothyronine (T3) in broilers were determined. Broilers were fed either 2600 or 2900 Kcal/d with 128, 133.3, 139.1, 145.5 and 152.4 energy and protein ratio for starting period, 145.5, 152.4 160. 168.4 and 177.8 energy protein ratio for growing period and 160, 168.4, 177.8, 188.2 and 200 energy and protein ratio for finishing periods from wing vein. Blood samples were kept at 4°C until centrifugation. A saturated sodium citrate solution (40 μl) of sodium citrate solution/ml blood) was added to the samples before centrifugation to prevent clotting of plasma during storage. Plasma was stored at 20°C until assayed for GH, T4 and T3 by RIA. Body weight and feed conversion were also measured at the end of starting, growing and finishing period. Mean concentrations of plasma GH were significantly higher ($p<0.01$) in the broilers fed 2600 Kcal/d than those fed 2900 Kcal/d during starting, growing and finishing periods. Moan concentrations of plasma T3 were gradually decreased ($p<0.05$) in broilers fed 2600 Kcal/d from starting to growing and finishing periods. Mean concentrations of plasma T4 was not changed in the starters, growers and finisher fed either 2600 or 2900 Kcal/d. Different protein levels didn't change the mean concentrations of T4 and T3 among starter, growers and finisher. The result of this experiment indicate that different protein levels during starting, growing and finishing period in broilers may not change the plasma concentration of GH, T4 and T3. The low energy intake may increase mean plasma concentrations of GH and decrease mean plasma concentrations of T3.

Key words: Protein rtios, plasma concentration, growth hormone, broilers

Introduction

Poor nutrition is associated with imbalanced metabolic hormones level in plasma of mammals. Several studies have shown that changes in energy and protein ratio in diet are associated with increased or decreased levels of the concentration of growth hormone (GH), thyroxine (T4) and tniodothyronine (T3) in serum of mammals (Armstrong and Britt, 1987). As with the mammals, birds are susceptible to imbalanced metabolic hormones level associated with changes of energy content in diet. For example, lower energy content resulted in a lower metabolic rates, less heat production, less oxygen consumption and reduced feed conversion rate (Scheele *et al.,* 1991) and increasing in a energy content in diet resulted in increasing metabolic rate, more oxygen consumption and reduced in increasing metabolic rate, more oxygen and increasing the feed conversion rate (Scheele *et al.*, 1991). It is well known that thyroid activity is important in controlling metabolic rate. Administration of T3 and T4 increased metabolic rate (Klandorf *et al.,* 1981). It is well suggested that there is a negative correlation between the plasma concentration of T3 and GH in chicken (Decuypere *et al.,* 1987). This correlation is mostly observed with lipid metabolism and lower energy content (Harvey *et al.,* 1983). There are a few studies about the correlation between GH and thyroid hormones with different dietary energy and protein ratio in broiler. Therefore the goal of this study was to determine whether different dietary energy and protein ratios can affect on the plasma concentration of GH, T4 and T3 in broiler.

Materials and Methods

Animals and diets: Three thousands one day old broilers aere assigned randomly to either 2600 or 2900 Kcal/d during starting, growing and finishing periods. Energy and protein ratios were adjusted to 128, 133.3, 139.1, 145.5 and 152.4 for starters, 145.5, 152 4, 160. 168.4 and 177.8 for growers and 160, 168.4, 177.8, 188.2 and 200 for finishers.

Protein and lysine ratio were adjusted to 19.2, 20 and 21.2 for starting, growing and finishing periods respectively. Protein and methionine plus cysteine ratio were adjusted to 24.7, 28 and 30 for starting, growing and finishing periods respectively. Diets were prepared with corn and soybean meal and formulated to provide the same daily quantities of vitamins, minerals and protein, which met or exceeded the recommendations of the NRC (1988).

Blood Collection: Blood samples were collected at the end of starting, growing and finishing periods from wing vein. Blood samples were kept at 4°C until centrifugation. A saturated sodium citrate solution (40 μl of sodium citrate solution/ml blood) was added to the samples before centrifugation to prevent clotting of plasma during storage. Plasma was stored at -20°C until assayed for GH, T4 and T3 by RIA. Body weight and feed conversion were also measured at the end of starting, growing and finishing period.

Hormone Assays: Plasma GH, T4 and T3 were measured by a homologous double-antibody radioimmunoassy (RIA). For GH assay, GH (Tabeshyarnoor Co., Tehran, Iran) were used for iodination. A seven-point standard curve ranging from 0.50 to 100 ng GH were used. An average assay binding of 40%, was achieved using an initial 1:20,000 dilution of GH antiserum for GH assay. For T4 assay, T3 were purchased

from Sigma Chemical Company and T4 antisera were purchased from Chemicon Co. (Temmecula, Ca). T3 were used for iodination. A six point standard curve ranging from 2.2 to 25 ng 14 antiserum for T4 assay.

For T3 assay, T2 were purchased from Sigma Chemical Company and T3 antisera were purchased from Chemicon Co. (Temmecula, Ca). T2 were used for iodination. A six point standard curve ranging from 0.32 to 5.2 rig T3/ml were used. An average assay binding of 70% was achieved using an initial 1:5000 dilution of T3 antiserum for T3 assay. Intra and interassay CV were 8.8 and 10.6% for GH, 8.1 and 7.3% for T3 and 9.3 and 8.8% and 8.3% for T4 respectively.

Statistical Analysis: All analysis were conducted using General Linear Model procedures (SAS, 1985). Hormonal data were analyzed using an analysis of variance for a split-split plot in time design. The main plot was treatment, the subplot day within treatment and sub-sub-plot time within day. Mean comparisons were evaluated by least square analysis of variance test.

Results

Table 1 shows that the broilers fed 2600 Kcal/d gain less mean body weight than the those fed 2900 Kcal/d. Mean feed conversion was higher in the broilers fed 2600 Kcal/d than the those fed 2900 Kcal/d. There were no differences due to energy and protein ratios on mean body weight and mean teed conversion in the broilers fed either 2600 or 2900 Kcal/d.

The broilers fed 2600 Kcal/d had higher mean concentrations of plasma GH than those fed 2900 Kcalid during starting, growng and finishing periods (Fig. 1). There were no significant differences of mean concentrations of plasma GH in broilers fed different protein levels in each groups of starters, growers and finishers (Fig. 1). Mean concentrationof plasma T3 were significantly lower in the broilers fed 2600 Kcal/d than those led 2900 Kcal/d during starting, growing and finishing periods in Fig. 2 and 3.

Also, mean concentrations of plasma T3 were gradually decreased in the broilers fed 2600 Kcal/d during starting, growing and finishing periods. Mean concentrations of plasma T4 was not changed in the starters, growers and finisher fed either 2600 or 2900 Kcal/d. There were no significant differences of mean concentrations of mean plasma T4 and T3 in broilers fed different protein levels in each groups of starters, growers and finishers in Fig. 2 and 3.

Table 1: Effect of different energy and protein ratios on body weight and feed conversion in broilers

E/P Ratio	2600 (Kcal/d)		2900 (Kcal/d)	
	BW (g)	FC	BW (g)	FC
160	1822	3.1	2030	2,7
168.4	1718	3.0	2010	2.6
177.8	1802	2.8	1940	2.5
188.2	1753	2.8	1960	2.6
200	1661	3.1	1930	2.6

Discussion

The goal of the study was to determine whether there were changes in plasma concentrations of GH, T4 and T3 in the broilers fed different energy, protein ratios in diet during starting, growing and fishing periods. One of the finding of this study was that broilers fed 2600 Kcal/d had higher

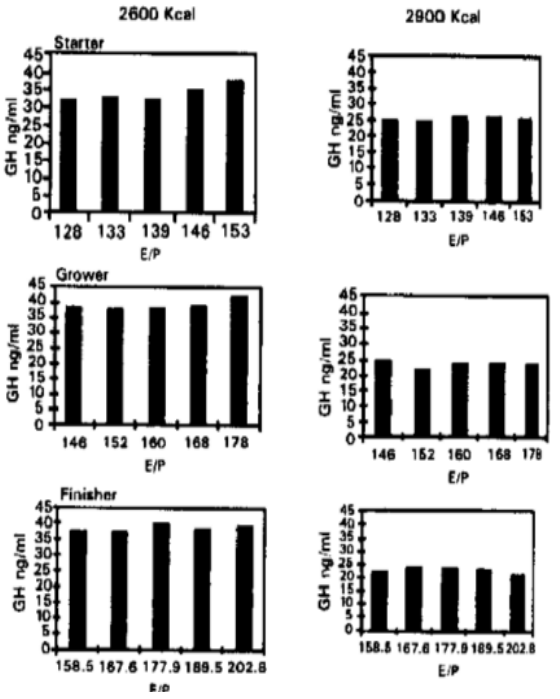

Fig. 1: Mean concentrations of GH in plasma of the starters, growers and finishers fed either 2600 or 2900 Kcal/d with 5 different protein levels. Blood samples were collected from thew legs of broilers and were assayed for GH by RIA. Broilers fed 2600 Kcal/d had higher ($p < 0.01$) mean concentrations of plasma GH than those fed 2900 Kcal/d during starting, growing and finishing periods. There werer no significant differences of mean concentraitons of plasma GH in broilers fed different protein levels in each groups during starters, growers and finishers

mean concentrations of plasma GH than those fed 2900 Kcal/d during staring, growing and finishing periods. These results are similar to the finding of previous study that showed lower energy content of diet may increase the plasma concentrations of GH in broilers. This may be due to the lower plasma glucose concentrations associated with higher plasma free fatty acid for ATP production.

The other finding of this study was that the broilers fed 2600 Kcal/d had lower mean concentrations of plasma T3 than those fed 2900 Kcal/d during starting, growing and finishing periods. These results are similar to the finding of previous study that showed a negative correlation between the plasma concentrations of T3 and GH in chicken (Decuypere *et al.,* 1987). This correlation is mostly observed with lipid metabolism and lower energy content, lower metablica rate, less heat production and less oxygen consumption (Scheele *et al.,* 1991). Mean concentration of plasma T3 were gradually decreased in the broilers fed 2600 Kcal/d during starting, growing and finishing periods. This may be due to the gradutlay increased maintenance energy requirment from starting to growing and finishing periods. Mean concentraions of plasma T4 was not changed in the starters, growers and finisher fed either 2600 or 2900 Kcal/d. This result are different from the finding of (Klandorf *et al.* (1981) that showed lower metabolic rate decrease plasma concentrations of T4. This might be due to lower dietary energy content experienced

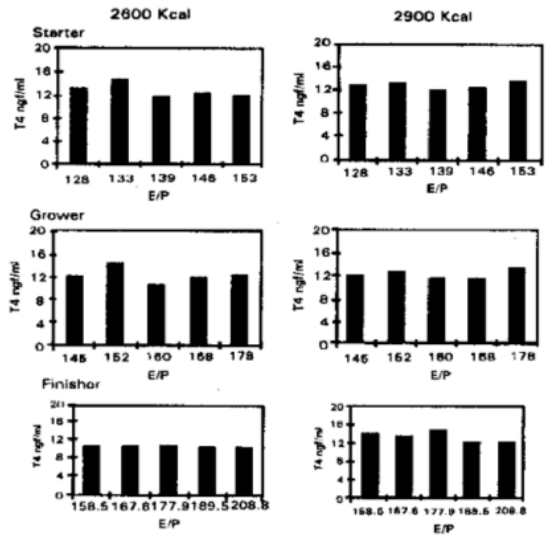

Fig. 2: Mean concentrations of T4 in plasma of the starters, growers and finishers fed either 2600 or 2900 Kcal/d with 5 different protein levels. Blood samples were collected from the wings of broilers and were assayed for T4 by RIA. Mean concentrations of plasma T4 was not changed in the starters, growers end finisher fed either 2600 or 2900 Kcal/d. There wre no significant differences of mean concentrations of plasma T4 in broilers fed different protein levels in each groups during starting, growing and finishing period

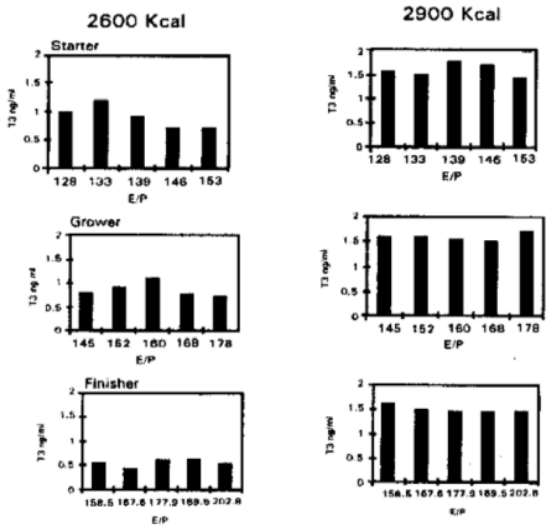

Fig. 3: Mean concentrations of T3 in plasma of the starters, growers and finishers fed either 2600 or 2900 Kcal/d with 5 different protein levels. Blood samples were collected from the wings of broilers and were assayed for T3 by RIA. Mean concentration of plasma T3 were significantly lower ($p<0.01$) in the broilers fed 2600 Kcal/d than those fed 2900 Kcal/d during starting, growing and finishing periods. Also, mean concentration of plasma T3 were gradually decreased in the broilers fed 2600 Kcal/d during starting, growing and finishing periods. There were no significant differences of mean concentrations of plasma T3 in broilers fed different protein levels in each groups during starters, growers and finishers periods in their study.

There ware no significant differences of mean concentrations of plasma GH, T3 and T4 in broiler fed different protein levels. This may be due to the fact that metabolic rate may not be under the protein levels. This may be due to the fact that metabolic rate may not be under the protein levels experienced in this study. As expected, broilers fed 2600 Kcal/d gain less weight than the those fed 2900 Kcal/d. Feed conversion was higher in the broilers fed 2600 Kcal/d than those fed 2900 Kcal/d. This may be due to being in a negative energy balance and catabolic stage to produce maintenance energy.

In conclusion, the results of this study clearly demonstrate that different protein levels during starting, growing and finishing period in broilers may not change the plasma concentration of GH, T4 and T3. Lower energy intake during staring, growing and finishing periods in broilers in associated with an increase in plasma concentrations of GH and a decreased in plasma concentrations of T3.

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