Effect of Using Different Crude Protein and Lysine Levels on Performance Parameters of Turkey Pullets

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ABSTRACT

This study was conducted using 216 (one day old) BUT7 Big Turkey chicks, to investigate the effect of sex (108 males and 108 females), two levels of protein (90 and 100% of the requirements) and three levels of lysine (90, 100 and 110% of the requirements) on the turkey's performance. Turkey chicks were allocated into 12 treatment combinations (TC) with three replicates per treatment; each replicate included 6 pullets. The experiment was divided into three periods, the first period from 15 to 42 days of age, the second period from 43 to 63 and the third period 64 to 84 days of age. The TC was given the following crude protein (CP) and Lysine levels: T1: 90% CP and 90% lysine. T2: 90% CP and 100% lysine. T3: 90% CP and 110% lysine. T4: 100% CP and 90% lysine. T5: 100% CP and 100% lysine. T6: 100% CP and 110% lysine. Diets containing 100% CP, at all ages resulted in a significant ($P \leq 0.05$) increase in body weight, weight gain, feed intake and feed conversion ratio compared to 90% CP. When percentage of lysine increased in diet of 100% CP in each period, positive responses were obtained in body weight, weight gain, feed intake and feed conversion ratio compared to diet of 90% CP with different levels of lysine. The results obtained suggested that a CP reduction of 10% in turkey diets could be possible, as long as a corresponding relationship exist among the amino acids. Increases of lysine in low protein diets could allow an unbalance among the essential amino acids, so a reduction in productive performance can be observed in the turkeys. On the other hand, increase lysine in diets with protein according requirements allowed an increase in the productive performance until a point where no longer there was improvement in the productive performance of the turkeys. These assertions emphasize to lysine like an amino acid from which an ideal protein model for turkeys can be designed. Also, more information on the ideal relationship among amino acids in diets for turkeys is necessary due to the continuous genetic improvement in that specie.

Keywords: turkey, requirements, protein, lysine, performance.

INTRODUCTION

The demand for inexpensive animal products as a protein food source is expected to increase (Coleman and Korver, 2004). The poultry industry are ideally suited to meet the needs of a growing human population by producing inexpensive, high quality and nutritious meat products, quickly and efficiently. Despite the recent economic downturn in the years 2007-2010, the demand for poultry meat products continues to remain strong due to its lower cost relative to pork and beef (USDA, 2009; USDA, 2010). Because of its higher feed conversion ratio and faster production process, the poultry industry is better able to adapt when feed costs are high and demand is low when compared to red meat industries (USDA, 2010). While, there have been relatively few studies that have addressed digestible

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Received on 27/7/2015 and Accepted for Publication on 20/3/2016.

amino acid requirements of turkeys, none have covered the full productive life of commercial toms (Firman and Boiling; 1998, Baker *et al.,* 2003). Formulating diets on a digestible amino acid basis has the potential to reduce feed cost through a reduction in total dietary protein thus enabling greater flexibility in the feed formulation ingredient matrix (Baker *et al.,* 2003). It is commonly achieved that greater performance in chicks can be achieved if the essential amino acids (EAA) in low CP diets were equivalent to those needed in the higher CP diets and when a balance of AAs is maintained (Pinchasov *et al.,* 1990; Ciftic and Ceylan, 2004). Hurwitz *et al.* (1998) concluded that when the CP level is reduced, the requirements for individual amino acid decreased due to growth retardation resulting from single or multiple amino acid deficiencies. Moreover, Lysine was used in the development of ideal amino acid ratios to express all other essential AA as a percentage of lysine, under the ideal protein concept (Baker and Han, 1994; Emmert and Baker, 1997; Baker *et al*., 2002). Therefore, the objective of this study was to evaluate the effect of different ratios of protein and lysine on the performance of commercial BUT 7 Big Turkeys.

MATERIALS AND METHODS:

The present study was conducted using one day old (108 males and 108 females) turkey chicks of BUT 7. A total of 216 chicks were reared at one room for adaptation. All chicks were offered the same diet *ad libitum* during the first 14 days of age. The diets were formulated to meet or according to the recommendations of BUT 7 Big Turkeys producer guideline. Water was provided *ad libitum* throughout the experiment periods and room was illuminated with 23 hour of light/day. On the fourteen day of age, the pullets were distributed into twelve treatments combinations; each treatment contains three replicates with 6 pullets /replication. The experiment was conducted at uniform rooms. After that six types of diets were used throughout the periods of experiment per each sex. Three diets were used: starter diet (15-42 days of age), grower diet (43-63 days of age) and finisher diet (64-84days of age) Table (1).

Table 1: Level of protein and lysine offered for each treatment combination (TC) at during the three periods of the experiment.

	Treatment combination	Experimental periods					
		days (15-42)		days (43-63)		days (64-84)	
		% Protein	% Lysine	% Protein	% Lysine	% Protein	% Lysine
Levels of protein and lysine in diet	TC 1 and TC 7	90*	90[a]	90	90	90	90
		23.40**	1.54[aa]	21.7	1.32	18.90	1.13
	TC 2 and TC 8	90	100	90	100	90	100
		23.40	1.71	21.70	1.44	18.9	1.26
	TC 3 and TC 9	90	110	90	110	90	110
		23.40	1.92	21.70	1.55	18.9	1.38
	TC 4 and TC 10	100	90	100	90	100	90
		26	1.54	24	1.32	21	1.13
	TC 5 and TC 11	100	100	100	100	100	100

		26	1.71	24	1.44	21	1.26
	TC 6 and TC 12	100	110	100	110	100	110
		26	1.92	24	1.55	21	1.38

*: level of protein offered compared with total needed; **: percent of protein.

[a]: level of lysine offered compared with total needed; [aa]: percent of lysine.

Experiment design:

The following treatments were used to provide birds with 2 levels of protein (90 or 100% of the requirements) combined with 3 levels of lysine (90, 100 and 110% of the requirements):

Treatment 1: 90% protein+ 90% lysine.

Treatment 2: 90% protein+ 100% lysine

Treatment 3: 90% protein+ 110% lysine

Treatment 4: 100% protein+ 90% lysine

Treatment 5: 100% protein+ 100% lysine

Treatment 6: 100% protein+ 110% lysine

Performance parameters

The following parameters were measured during the experiment: live body weights, weight gain, feed intake and feed conversion ratio (FCR). The measurements were performed at three periods and for each measure three replicates were taken.

Statistical analysis

Analysis of data was carried out according in a 2*2*3 Factorial arrangement of CRD using XLSTAT program (version 7.5, 2004), Duncan multiple range test was used to test the significance differences between means at 0.05 (Duncan, 1955). The mathematical model used to represent each piece of information was as the following:

$$Y_{ijkl} = \mu + A_i + B_j + C_k + (AB)_{ij} + (AC)_{ik} + (BC)_{jk} + e_{ijkl}$$

Y_{ijkl} = Observation l in level i of factor A, level j of factor B and level k of factor C

μ = Overall mean.

A_i = Sex effect of i level (i = 1, 2; for male or female).

B_j = Protein effect of j level (j = 1, 2 for protein level).

C_k = Lysine effect of k level (k = 1, 2, 3 for lysine level).

$(AB)_{ij}$ = Effect of interaction between sex and protein level.

$(AC)_{ik}$ = Effect of interaction between sex and lysine level.

$(BC)_{jk}$ = Effect of interaction between protein and lysine level.

e_{ijk} =Experimental error assumed to be $(0, \sigma^2 e)$.

RESULTS AND DISCUSSION:

Body weight:

The results of body weight (BW) at the three periods are presented in Table 2. For the effect of sex on body weight in the first, second and third periods of age, male turkeys grew faster and had a higher body weight ($P \leq 0.05$) in comparison with the females. There was significant ($P \leq 0.05$) effect of sex on body weight in all periods due to rapid growth rate, higher feed intake and FCR in males compared to females. This is in agreement with the results of Wegner (1987) who found that male turkey shows a higher growth than females. In spite of turkey diet contained level of 90% CP body weight more in turkey male than in female turkeys as level of 100% CP, due to effect of sex. Crude protein had significantly increased BW, in all periods especially at third period. Body weights in turkey fed diet containing 100% CP were significantly heavier ($P \leq 0.05$) than 90% CP. Moreover, protein requirements vary considerably according to the rate of growth of the birds. For instance, rapidly growing turkey pullets and broiler chickens have high protein requirements to meet (Sklan and Noy, 2003). The effect of lysine levels

on BW, in the first period was no significant. Whereas, in second and third periods the highest BW were obtained at lysine levels of 110% compared to 90%. Because body weight of turkeys increased as dietary lysine increased. Such results are in agreement with those reported by Lilburn and Emmerson (1993) and Waldroup *et al.* (1997a, b). For all periods, significant differences ($P \leq 0.05$) between BW of sex-CP interaction were found, all male turkeys that were received 100% CP had a higher body weight ($P \leq 0.05$) in comparison with 90% CP in female turkeys due to the effect of sex and CP together. On the other hand, sex and lysine levels interaction were clarified in the first period, body weight of pullets from male turkey groups and lysine levels 90, 100 and 110% were 1.67, 1.68, 1.69 kg, respectively. These weights were significantly higher ($p<0.05$) than those of female turkey groups being 1.20, 1.19, 1.19kg, respectively. Whilst, the difference among lysine levels of 90, 100 and 110% were not significant for both sexes. In second period there were significant differences ($P \leq 0.05$) in body weight between levels of lysine 110% (2.77kg) in female turkeys compared to the level 90% (2.74kg). In third period, body weight of male turkey pullets at the three levels of lysine 90, 100 and 110% were 6.62, 6.68, 6.72kg, respectively. They were significantly higher ($p<0.05$) than those of female turkey groups at the same three levels of lysine (4.78, 4.83, 4.85g, respectively). Differences among levels of lysine 90, 100 and 110% of requirement were not significant in male turkeys. Moreover, body weight significantly differed ($P<0.05$) among level of lysine 90% and level of lysine 110% for both sexes. The effect of CP, lysine and their interactions on BW were also shown in Table 2. In the total period of experiment there were significant differences ($P \leq 0.05$) in body weight among levels of 100% CP with level lysine of 110% compared to level of 90% CP with lysine level of 110% of requirement in female turkeys. Body weight of turkeys fed diets contained 100% CP increased as the lysine level increased from 90 to 100 then to 110%, due to the increased level of dietary lysine additive to level of 100% CP. In the 90% CP the BW was tend to decrease as lysine level increased from 90 to 100 and 110%, respectively due to decrease level of CP. Similar trends were noticed for all periods. The lysine content in diets with 100% CP had to be higher to support of growing performance of the turkeys. The increased of CP in the diets, increased also content of other AA such as arginine and valine, so, the increased of lysine to keep an appropriate relationship among AA could be required. The imbalance in the essential amino acids could be caused by the increasing level of the CP or the AA, without consideration of the relation between both (Corzo *et al.*, 2002). It has been suggested that amino acids requirements in broiler increases linearly with dietary CP (Morris *et al.*, 1992). The mechanism of this action is unknown, but the amino acids imbalance may be the most important factor for Amino acids needs (Morris *et al*., 1999).

Also there was no significant differences of level of lysine on BW of turkeys as fed diets contained 90% of CP compared to 100% of CP, in spite of BW was tend to decrease as lysine level increased from 90 to 100 and 110% due to decrease level of CP and imbalance between amino acids. Similar situations were found for most periods of experiment Table 2. The disorder association between amino acids, viz increase one amino acid and decrease other amino acids also adversely affect the bird performance due to the absence exactly balance for ideal protein. Ideal protein is the exact balance of AA's needed for growth and maintenance without excesses or deficiencies have recently been estimated for the turkey (Firman and Boling, 1998). While, according to Lemme *et al.* (2002): dietary AA imbalances result in a reduction of BW and reduction of carcass yield. In addition, Hurwitz *et al.* (1998) concluded that when the CP level is reduced, the requirements for individual amino acid decreased due to

growth retardation resulting from single or multiple amino acid deficiencies. Kidd and Kerr (1998) reported that arginine and lysine are structurally related amino acids and feeding higher levels of one without consideration of the other may result in an amino acid antagonism that decreases growth. Although, Zuprizal *et al.* (1992) concluded that the poor performance of turkey poults fed a 22% compared with a 30% crude protein diet may have been due more to a decadency of nitrogen percent rather than to any one amino acid being limiting. These results are also associated to the hypothesis suggesting that an adequate balance among the dietary AA it is necessary in order to meet the requirements of the birds (Applegate *et al*., 2008; Baker *et al*., 2003; Boling and Firman, 1998; Firmanand Boling, 1998). According to Lemme *et al.* (2002) the dietary AA imbalances result in a reduction of BW. The results obtained in this experiment indicate that diets containing 90% CP and 90% lysine supported the body weight and growing performance of the turkeys, while, in diets having 100% CP, the 90% of lysine was not sufficient. The lysine content in diets with 100% of CP had to be higher to sustain the growing performance of the turkeys. The increased of CP in the diets, increased also content of other AA such as arginine and valine, so, the increased of lysine to keep an appropriate relationship among AA could be required. The imbalance in the essential amino acids could be caused by the increasing level of the CP or the AA, without consideration of the relation between both (Corzo *et al*., 2002).

Table 2: Effect of sex, crude protein levels and lysine levels on body weight (kg)[A]

Factors			Periods		
			days (15-42)	days (43-63)	days (64-84)
Sex		Males	1.68±0.02[a*]	4.05±0.08[a]	6.67±0.11[a]
		Females	1.20±0.03[b]	2.76±0.10[b]	4.82±0.14[b]
CP		90%	1.36±0.06[b]	3.01±0.17[b]	5.23±0.24[b]
		100%	1.51±0.05[a]	3.80±0.14[a]	6.26±0.20[a]
Lysine		90%	1.43±0.07[a]	3.39±0.22[b]	5.67±0.29[b]
		100%	1.43±0.08[a]	3.40±0.22[ab]	5.75±0.32[a]
		110%	1.44±0.08[a]	3.42±0.23[a]	5.78±0.33[a]
Sex and CP	Males	90% CP	1.64±0.01[b]	3.70±0.01[b]	6.25±0.02[b]
		100% CP	1.72±0.02[a]	4.37±0.02[a]	7.09±0.05[a]
	Females	90% CP	1.09±0.01[d]	2.30±0.01[d]	4.22±0.03[d]
		100% CP	1.29±0.01[c]	3.20±0.02[c]	5.42±0.04[c]
Sex and Lys	Males	90% Lys	1.67±0.01[a]	4.05±0.12[a]	6.62±0.12[b]
		100% Lys	1.68±0.02[a]	4.04±0.15[a]	6.68±0.20[a]
		110% Lys	1.69±0.04[a]	4.07±0.18[a]	6.72±0.24[a]
	Females	90% Lys	1.20±0.03[b]	2.74±0.17[c]	4.78±0.20[d]
		100% Lys	1.19±0.05[b]	2.76±0.20[b]	4.83±0.29[c]

		110% Lys	1.19±0.06[b]	2.77±0.22[b]	4.85±0.31[c]
CP and Lys	90% CP	90% Lys	1.40±0.13[d]	3.10±0.31[c]	5.34±0.45[d]
		100% Lys	1.35±0.12[e]	3.00±0.31[e]	5.20±0.45[e]
		110% Lys	1.33±0.12[e]	2.97±0.31[e]	5.16±0.45[e]
	100% CP	90% Lys	1.46±0.08[c]	3.72±0.27[b]	6.06±0.37[c]
		100% Lys	1.51±0.09[b]	3.84±0.25[a]	6.30±0.36[b]
		110% Lys	1.55±0.10[a]	3.86±0.27[a]	6.41±0.38[a]

*Means with different superscript within factor or factors combination differ significantly ($p \leq 0.05$).

[A] (Means ±SE) of turkey pullets.

Weight gain

The effect of sex, CP and lysine levels on BWG for both sexes are shown in Table 3. In total periods sex had significant effect on WG, in (64-84 days), BWG ranged between 2.62kg and 2.06 kg for males and females turkeys, respectively. Such results were generally consistent with the growth studies by Han and Baker (1994) which indicating that male growing chickens gained faster (12%) than females due to higher daily feed intake in males, Zuprizal *et al.* (1992). Thus, similar results were also obtained by May and Lott, (2001) who reported that weight gain equation predicts of maximum for males as compared to females. The significant effects of CP levels ($P<0.05$) on weight gain were also noticed for all periods of experiment. This result agreed with Sterling *et al.* (2003) which concluded that increasing CP level in growing period increased BWG and feed intake. Moreover, it was shown that a delay in body weight gain due to suboptimal crude protein levels in the starter diet decreased growth rate in the growing phase of broilers (Wijtten *et al.,* 2004), although other reported that decreasing dietary CP resulted in a decrease in average daily gain (ADG) (Bregendahl *et al*., 2002). Also Rezaei *et al*. (2004) reported that reducing dietary protein decreased weight gain in total period of experiment. While, other study observed that reducing dietary CP by 2% did not affect body weight gain (Moran and Stilborn, 1996). On the other hand, in first and second periods lysine was not significantly affected WG. Meanwhile, in third period, levels of lysine 110% resulted in a higher WG compared to levels of lysine 90%. The significant positive linear relationship between the increase in dietary lysine and the daily gain and food consumption found in the current study in turkeys fed 100% CP diets, is in good agreement with the linear response reported by Veldkamp *et al*. (2000). Moreover, the effect of sex and CP levels interaction on body weight gain significantly differed ($P<0.05$) among male turkeys that received 100% CP and female turkeys which received 90% CP in the overall periods. Such effect may be attributed to the size of males.

The WG of birds fed diets with 100% of CP increased as the lysine level increased. The significant positive linear relationship between the increase in dietary lysine and the daily gain and food consumption in all periods found in our study is in agreement with the linear response reported by Veldkamp *et al.* (2000). On the other hand, the WG of turkeys fed diets contained 90% of CP; tend to decreased as lysine level increased from 90 to100 and 110%, for all periods Table 3. The negative response observed in 90% CP diets as lysine increased, is due to the antagonistic reaction between lysine and other AA, particularly with arginine (Brake *et al.,* 1998) and valine, leucine and isoleucine that are important for optimum growth (Lemme *et al.,* 2004). These results are also associated to the hypothesis suggesting that an adequate balance among the dietary AA is necessary in order

to meet the requirements of the birds (Applegate *et al.*, 2008; Baker *et al.*, 2003; Boling and Firman, 1998; Firman and Boling, 1998). Previous experiments have reported that decreasing dietary CP resulted in a decrease in average daily gain (ADG) (Lemme *et al.*, 2004). In addition to this, Sterling *et al.* (2003) reported a decreased feed efficiency and growth rate when low protein diets were fed to broilers. Moreover, it was shown that a delay in body weight gain due to suboptimal crude protein levels in the starter diet decreased growth rate in the growing phase of broilers (Han *et al.*, 1992).

Table 3: Effect of sex, crude protein levels and lysine levels on weight gain (kg/period)[A]

Factors			Periods		
			days (15-42)	days (43-63)	days (64-84)
Sex		Males	1.37±0.01[a*]	2.37±0.07[a]	2.62±0.02[a]
		Females	0.91±0.01[b]	1.57±0.08[b]	2.06±0.04[b]
CP		90%	1.109±0.05[b]	1.65±0.10[b]	2.22±0.07[b]
		100%	1.17±0.05[a]	2.29±0.09[a]	2.46±0.06[a]
Lysine		90%	1.15±0.06[a]	1.96±0.15[a]	2.31±0.08[b]
		100%	1.14±0.07[a]	1.97±0.15[a]	2.35±0.09[a]
		110%	1.14±0.07[a]	1.98±0.16[a]	2.37±0.10[a]
Sex and CP	Males	90% CP	1.34±0.01[b]	2.07±0.01[b]	2.54±0.01[b]
		100% CP	1.40±0.01[a]	2.67±0.01[a]	2.70±0.03[a]
	Females	90% CP	0.88±0.01[d]	1.22±0.01[d]	1.91±0.02[d]
		100% CP	0.10±0.01[c]	1.91±0.08[c]	2.22±0.03[c]
Sex and Lys	Males	90% Lys	1.37±0.02[a]	2.38±0.13[a]	2.57±0.01[b]
		100% Lys	1.37±0.02[a]	2.36±0.13[a]	2.64±0.05[a]
		110% Lys	1.37±0.02[a]	2.38±0.14[a]	2.65±0.06[a]
	Females	90% Lys	0.92±0.01[b]	1.54±0.14[c]	2.04±0.03[c]
		100% Lys	0.91±0.02[b]	1.58±0.16[b]	2.06±0.08[c]
		110% Lys	0.91±0.03[b]	1.58±0.16[b]	2.08±0.09[c]
CP and Lys	90% CP	90% Lys	1.13±0.10[bc]	1.66±0.19[c]	2.28±0.14[c]
		100% Lys	1.10±0.12[c]	1.65±0.19[c]	2.19±0.14[d]
		110% Lys	1.10±0.12[c]	1.64±0.19[c]	2.20±0.15[d]
	100% CP	90% Lys	1.16±0.10[ab]	2.26±0.18[b]	2.34±0.10[b]
		100% Lys	1.17±0.10[a]	2.29±0.16[a]	2.50±0.11[a]
		110% Lys	1.19±0.09[a]	2.32±0.17[a]	2.54±0.11[a]

*Means with different superscript within factor or factors combination differ significantly ($p \leq 0.05$).

[A] (Means ±SE) of turkey pullets.

Feed intake

Data of the feed intake (FI) is shown in Table 4. In the overall periods of experiment male turkey had significantly increased FI. Male turkeys can better compensate for the deficiency in amino acids than females, due to their higher feed intake (Jeroch and Lehmann, 1998). With increasing CP levels in whole period of the experiment feed consumption was improved significantly ($P \leq 0.05$). A decrease in feed intake with reduced protein density has been reported in broiler chickens (Kemp et al., 2005; Berhe and Gous, 2005), those authors reported that Ross 308 broiler chickens decreased their feed intake as dietary protein content was reduced, resulting in a lower growth rate. Also, this result agreed with Sterling *et al.* (2003) which concluded that increasing CP level in growing period increased BWG and feed intake. However, FI was decreased with low CP diets (Si *et al.,* 2004; Jiang *et al.,* 2005). Consequently, Urdaneta-Rincon and Leeson (2004) stated that feed intake is influenced by dietary crude protein and amino acid levels, and that a deficiency or excess of amino acids will reduce feed intake. While Han *et al.* (1992) found no differences in feed intake of broilers when the CP content of the diet was decreased from 23 to 20%. However, in first and second periods lysine levels were not significantly affect FI, whilst in third period the FI in the lysine level 110% was higher compared with lysine level 90%. Moreover, in overall period, the highest values of feed intake were obtained when levels of 100% CP in male turkeys compared to levels of 90% CP in female turkeys, due to effect of sex and CP level together. In the second period FI in female turkeys increased when lysine level increase in 90 to 100 and 110%, which being 2.74, 2.81, 2.82kg, respectively. The effect of CP and lysine levels interaction on FI of turkey pullets are declared in Table 4. In second and third period FI significantly differed ($P<0.05$) among level of 90% CP with lysine level 90, 100 and 110 and level of CP 100% with different level of lysine. While, the feed intake of turkeys with 100% CP increased as the lysine level increased from 90 to 110. On the other hand, in most periods the FI of turkeys fed diets with 90% CP; tend to decreased as lysine level increased from 90 to 110%, respectively (Table 4). Turkeys that were fed the lowest levels of dietary lysine from 43 to 63 days of age gained less weight than those birds fed the higher levels of dietary lysine. This advantage in weight gain could have been associated with a reduced capacity of feed intake and consequently adversely affected the ability to estimate dietary lysine requirements during the succeeding age intervals. it can be concluded that for feed intake and BW gain, turkeys did respond to increased lysine levels in each period Sterling *et al.*,(2003)

Table 4: Effect of sex, crude protein levels and lysine levels on feed intake (kg/period)[A]

Factors		Periods		
		days (15-42)	**days (43-63)**	**days (64-84)**
Sex	Males	2.09±0.02[a*]	4.35±0.14[a]	6.06±0.07[a]
	Females	1.30±0.01[b]	2.79±0.15[b]	4.12±0.08[b]
CP	90%	1.63±0.09[b]	2.97±0.20[b]	4.79±0.24[b]
	100%	1.76±0.10[a]	4.17±0.18[a]	5.39±0.23[a]
Lysine	90%	1.69±0.12[a]	3.56±0.30[a]	5.05±0.29[b]
	100%	1.69±0.12[a]	3.56±0.29[a]	5.10±0.31[a]

Factors			Periods		
			days (15-42)	**days (43-63)**	**days (64-84)**
		110%	1.70±0.12[a]	3.58±0.23[a]	5.12±0.32[a]
Sex and CP	Males	90% CP	2.01±0.02[b]	3.78±0.01[b]	5.79±0.02[b]
		100% CP	2.16±0.01[a]	4.90±0.02[a]	6.33±0.04[a]
	Females	90% CP	1.24±0.01[d]	2.16±0.01[d]	3.79±0.03[d]
		100% CP	1.37±0.01[c]	3.41±0.02[c]	4.45±0.04[c]
Sex and Lys	Males	90% Lys	2.08±0.03[a]	4.37±0.26[a]	5.99±0.09[b]
		100% Lys	2.08±0.03[a]	4.30±0.24[b]	6.08±0.13[a]
		110% Lys	2.09±0.04[a]	4.35±0.26[ab]	6.11±0.14[a]
	Females	90% Lys	1.30±0.02[b]	2.74±0.25[d]	4.11±0.09[c]
		100% Lys	1.32±0.03[b]	2.81±0.29[c]	4.13±0.18[c]
		110% Lys	1.30±0.03[b]	2.82±0.29[c]	4.13±0.16[c]
CP and Lys	90% CP	90% Lys	1.63±0.17[b]	2.98±0.36[c]	4.85±0.42[c]
		100% Lys	1.62±0.17[b]	2.96±0.36[c]	4.75±0.45[d]
		110% Lys	1.62±0.17[b]	2.92±0.36[d]	4.77±0.45[d]
	100% CP	90% Lys	1.75±0.18[a]	4.14±0.36[b]	5.26±0.41[b]
		100% Lys	1.76±0.18[a]	4.16±0.31[ab]	5.46±0.41[a]
		110% Lys	1.77±0.17[a]	4.20±0.33[a]	5.46±0.43[a]

*Means with different superscript within factor or factors combination differ significantly ($p \leq 0.05$).

[A] (Means ±SE) of turkey pullets.

Feed conversion ratio

The results of feed conversion ratio (FCR) are shown in Table 5. There was significant effect of sex on FCR at all age. Male turkeys had significantly higher value in feed conversion ratio in the three periods being (1.52, 1.83 and 2.31, respectively) as compared to female turkeys (1.42, 1.77 and 1.99, respectively). Such difference may be due to higher feed intake, this result disagree with Veerapen and Driver (1999) who reported that males having a lower value of FCR as comparison to females flocks in chicken.

The values of FCR were increased at all ages as a result of increasing CP levels. According to Bregendahl *et al.* (2002) a decreased feed efficiency and growth rate were noticed when low protein diets were fed to broilers. Araujo *et al.* (2004) and Rezaei *et al.* (2004) also found no differences in FCR of the birds when fed low protein diets supplemented with AAs according to an ideal AAs ratio. Adversely, lowering dietary protein had no significant effect on feed conversion ratio in all phases (Rezaei *et al.*, 2004). However, feed conversion ratio did not differ significantly ($P \leq 0.05$) among dietary lysine levels. Such results are in agreement with those reported by Hesabi *et al.* (2008). While, the interaction between sex and CP have significant positive effect on FCR at all ages Table 5. In first, second and third periods there were significant differences ($P \leq 0.05$) in feed conversion ratio between levels of CP 100% (1.49, 1.82 and 2.28, respectively) in male turkeys compared to level of CP 90% in female

turkeys (1.54, 1.84 and 2.34, respectively).

CONCLUSION

The results obtained suggested that a CP reduction of 10% in turkey diets could be possible, as long as a corresponding relationship exist among the amino acids. Increases of lysine in low protein diets could allow an unbalance among the essential aminoacids, so a reduction in productive performance can be observed in the turkeys. On the other hand, increase lysine in diets with protein according requirements allowed an increase in the productive performance until a point where no longer there was improvement in the productive performance of the turkeys. These assertions emphasize to lysine like an amino acid from which an ideal protein model for turkeys can be designed. Also, more information on the ideal relationship among amino acids in diets for turkeys is necessary due to the continuous genetic improvement in that specie.

Table 5: Effect of sex, crude protein levels and lysine levels on FCR (kg feed: kg live body weight)[A]

Factors			Feed conversion ratio at		
			days (15-42)	days (43-63)	days (64-84)
Sex		Males	1.52±0.01[a]	1.83±0.01[a]	2.31±0.01[a]
		Females	1.42±0.01[b]	1.77±0.01[b]	1.99±0.01[b]
CP		90%	1.45±0.01[b]	1.79±0.01[b]	2.13±0.04[b]
		100%	1.49±0.02[a]	1.81±0.01[a]	2.17±0.04[a]
Lysine		90%	1.46±0.02[a]	1.8±0.01[a]	2.17±0.05[a]
		100%	1.48±0.01[a]	1.79±0.01[a]	2.15±0.05[a]
		110%	1.47±0.02[a]	1.80±0.01[a]	2.14±0.05[a]
Sex and CP	Males	90% CP	1.49±0.01[b]	1.82±0.00[b]	2.28±0.01[b]
		100% CP	1.54±0.01[a]	1.84±0.01[a]	2.34±0.02[a]
	Females	90% CP	1.41±0.01[c]	1.76±0.01[d]	1.99±0.02[c]
		100% CP	1.43±0.01[c]	1.79±0.01[c]	2.00±0.01[c]
Sex and Lys	Males	90% Lys	1.52±0.02[a]	1.83±0.01[a]	2.33±0.04[a]
		100% Lys	1.53±0.01[a]	1.82±0.01[a]	2.30±0.02[a]
		110% Lys	1.52±0.02[a]	1.82±0.01[a]	2.30±0.01[a]
	Females	90% Lys	1.41±0.02[b]	1.77±0.01[b]	2.01±0.02[b]
		100% Lys	1.43±0.01[b]	1.76±0.01[b]	2.00±0.02[b]
		110% Lys	1.43±0.01[b]	1.77±0.01[b]	1.98±0.02[b]
CP and Lys	90% CP	90% Lys	1.43±0.03[b]	1.78±0.02[c]	2.11±0.06[c]
		100% Lys	1.46±0.02[ab]	1.79±0.01[bc]	2.13±0.07[bc]
		110% Lys	1.47±0.02[ab]	1.79±0.02[bc]	2.15±0.07[b]
	100% CP	90% Lys	1.49±0.03[a]	1.82±0.01[a]	2.22±0.08[a]

Factors			Feed conversion ratio at		
			days (15-42)	days (43-63)	days (64-84)
		100% Lys	1.49±0.03[a]	1.81±0.01[ab]	2.17±0.07[b]
		110% Lys	1.48±0.03[a]	1.81±0.01[abc]	2.13±0.08[bc]

*Means with different superscript within factor or factors combination differ significantly ($p \leq 0.05$).

[A] (Means ±SE) of turkey pullets.

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تأثير استخدام مستويات مختلفة من البروتين الخام و اللايسين على الاداء الانتاجي لافراخ الرومي

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ملخص

أجريت هذه الدراسة باستخدام 216 من أفراخ الرومي (108 ذكر و 108 اناث) عرق (BUT7 Big Turkey) بعمر يوم واحد لدراسة تأثير الجنس، مستوين من البروتين الخام (90% و100% من الاحتياجات القياسية) و ثلاثة مستويات من الحامض الاميني اللايسين (90% ،100% و110% من الاحتياجات القياسية) على الأداء الإنتاجي لأفراخ الرومي. تم توزيع الأفراخ على 12 معاملة متداخلة بواقع ثلاثة مكررات لكل معاملة وستة افراخ لكل مكرر. قسمت التجربة الى ثلاثة مراحل، المرحلة الأولى ابتداء من عمر 15 الى 42 يوم، المرحلة الثانية من عمر 43 إلى 63 يوم والمرحلة الثالثة من عمر 64 إلى 84 يوم. شملت المعاملات: T1 : 90% بروتين و 90% من اللايسين من الاحتياجات القياسية. T2 : 90% بروتين و 100% من اللايسين من الاحتياجات القياسية.T3 : 90% بروتين و 110% من اللايسين من الاحتياجات القياسية.T4 : 100% بروتين و 90% من اللايسين من الاحتياجات القياسية. T5 : 100% بروتين و 100% من اللايسين من الاحتياجات القياسية.T6 : 100% بروتين و 110% من اللايسين من الاحتياجات القياسية. أظهرت النتائج أن العلائق المحتوية على 100% من البروتين في المراحل العمرية المختلفة قد سجلت زيادات معنوية ($P\leq0.05$) في وزن الجسم، الزيادة الوزنية، استهلاك العلف و معامل التحويل الغذائي مقارنة مع نسبة البروتين 90%. بينت النتائج انه مع ارتفاع نسبة حامض اللايسين في العليقة المحتوية على 100% من البروتين الخام في كل مرحلة عمرية كان هناك استجابة ايجابية من وزن الجسم، الزيادة الوزنية، استهلاك العلف ومعامل التحويل الغذائي مقارنة مع العلائق التي تحتوي على 90% من البروتين الخام مع المستويات المختلفة من اللايسين. نستنتج من النتائج ان ارتفاع نسبة اللايسين مع استخدام البروتين بنسبة 100% قد أدت إلى تحسن الأداء الإنتاجي لأفراخ الرومي.

الكلمات الدالة: الرومي، الاحتياجات القياسية، البروتين، اللايسين والأداء الإنتاجي.

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تاريخ استلام البحث 2015/7/27 وتاريخ قبوله 2016/3/20.