

EFFECT OF VARYING ENERGY/LYSINE RATIO ON GROWTH PERFORMANCE AND NUTRIENT DIGESTIBILITY OF GROWING LOCALLY ADAPTED TURKEY

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Abstract

Locally adapted turkeys were fed diets containing varying energy/lysine ratios in a four-week study to evaluate growth performance and nutrient digestibility. A total of 144 four-weeks old locally adapted turkey (poult) were completely randomized to six dietary treatments in a 2×3 factorial arrangement, replicated twice with 12 poult per replicate. Diets 1 to 3 contained 2900 kcal/kg ME (12.14 MJ/kg ME) at 13.50g/kg, 15.00g/kg and 16.10g/kg lysine at 260 g/kg CP levels; diets 4 to 6 contained 3000 kcal/kg ME (12.56 MJ/kg ME) at similar dietary lysine and CP levels. The resultant energy/lysine (E/Lys) ratio of diets 1 to 6 were 9:1, 8.1:1, 7.5:1, 9.3:1, 8.4:1 and 7.8:1 respectively. The daily feed intake and FCR of locally adapted turkeys were significantly ($P<0.05$) influenced by energy × lysine interaction. There was significant ($P<0.05$) effect of energy/lysine ratio on crude fibre (%) digestibility while energy × lysine interaction effect was observed on the dry matter (%), crude protein (%) and crude fibre (%) digestibility coefficient of locally adapted turkeys' diets. A higher metabolisable energy level (3000 kcal/kg ME) with 15.0g/kg lysine level and an energy/lysine ratio 8.4:1 is adequate for raising locally adapted turkey in the tropics.

Keywords: Locally adapted Turkey, Nutrient requirements, Energy/Lysine ratio, Poult, Lysine, Energy

Introduction

Dietary lysine is usually the second limiting amino acid for poultry fed corn-soybean meal diets and is used as the reference amino acid for the ideal amino acid profile because more information is known about its concentration in feedstuffs. Lysine is important in improving performance, especially with regard to breast meat yield of turkey (Café and Waldroup, 2006). The goal to meet the amino acid needs of modern turkey breeds has led to diet formulations with high protein contents of about 280g/kg in 1 to 4 weeks of age which are gradually decreased to approximately 160g/kg in 16 to 24 weeks of age (Aduku, 1993; NRC, 1994; Olomu, 1995). Nutritionists and producers have been using lysine supplements to meet the amino acid needs of turkey. Aduku, (1993) and NRC, (1994) recommended 15.00 g/kg total lysine at 2750 ME and 2900 ME respectively, while Olomu, (1995) recommended 16.00 g/kg total lysine at 2800 ME for turkeys of age 4 to 8 weeks. Information regarding the extent to which crude protein content of diets may be reduced by use of supplemental amino acids such as lysine without impairing performance is economically important to the turkey industry and researchers worldwide; Nigeria inclusive. This study therefore was conducted to determine the extent to which energy combination with a lower and higher level of lysine to the NRC (1994) recommendation will affect turkey performance within 4 to 8 weeks of age in the tropics.

Materials and Methods

The experiment was carried out at the Turkey Unit of the Teaching and Research Farm of Obafemi Awolowo University, Ile-Ife. One hundred and fifty day-old locally adapted turkey poult were fed common diet containing 2800 kcal/kg metabolisable energy (ME) and 300 g/kg crude protein (CP) for 4 weeks. Birds were brooded with electricity using incandescent bulbs and supplemental heat using heat produced from burning charcoal in pots. At 28 days of age, 144 four weeks locally adapted turkey (poult) were randomly selected and assigned to six dietary treatments in a floor pen on wood shavings of a completely randomized design in a 2×3 factorial arrangement with 24 poult per treatment at two replicates of 12 birds each. The dimension of each floor pen was approximately 14 m². The factors were two levels of metabolisable energy and three levels of dietary lysine. Diets 1 to 3 contained 2900 kcal/kg ME (12.14 MJ/kg ME) at 13.50 g/kg, 15.00 g/kg and 16.10 g/kg lysine and

260 g/kg CP levels; diets 4 to 6 contained 3000 kcal/kg ME (12.56 MJ/kg ME) at similar dietary lysine and CP levels. The corresponding energy/lysine (E/Lys) ratio of diets 1 to 6 were 9:1, 8.1:1, 7.5:1, 9.3:1, 8.4:1 and 7.8:1 respectively. The experimental diets are presented in Table 1. Water and feed were supplied *ad libitum*. Data on body weight changes and feed intake were recorded fortnightly and weekly respectively. Nutrient digestibility trial was carried out when poults were 6 weeks old following standard procedure of total faecal collection method. Two birds per replicate were randomly selected and put in digestibility cages. Faecal samples were collected from birds on daily basis for five days. Faecal samples collected were weighed on wet and dry basis to determine the moisture and dry matter content. Daily weight gain, daily feed intake and feed conversion ratio (FCR) were calculated. The proximate composition of the experimental diets and dried faecal samples were carried out as described by AOAC (2002). The study lasted for four weeks. Data were subjected to Factorial Analysis of Variance (ANOVA) ($p < 0.05$) using the General Linear Model of SAS (2008) package for windows.

Table 1: Composition of the Experimental Diets of Turkey Fed Varying Energy/Lysine Ratios (4 to 8 Weeks)

Metabolisable Energy (kcal/kg)	2900			3000		
Lysine levels (g/kg)	13.50	15.00	16.10	13.50	15.00	16.10
Energy/Lysine ratio	9 : 1	8.1 : 1	7.5 : 1	9.3 : 1	8.4 : 1	7.8 : 1
Experimental diets	1	2	3	4	5	6
Ingredients (g/kg):						
Maize	424.00	418.50	440.00	481.10	420.00	430.30
SBM	410.00	440.00	487.10	424.00	470.00	472.00
Wheat Offal	95.30	70.00	30.00	24.00	38.50	27.00
Fish Meal	30.00	30.00	10.00	30.00	20.00	20.00
Palm Oil	10.00	10.00	-	10.00	20.00	18.00
Bone Meal	20.00	20.00	20.00	20.00	20.00	20.00
Premix	5.00	5.00	5.00	5.00	5.00	5.00
Salt	5.00	5.00	5.00	5.00	5.00	5.00
Methionine	0.60	0.40	0.60	0.70	0.50	0.50
Lysine	0.10	1.10	2.30	0.20	1.00	2.20
Total	1000.00	1000.00	1000.00	1000.00	1000.00	1000.00
Calculated nutrients:						
ME (kcal/kg)	2907.0	2921.83	2910.83	3007.58	3000.47	3003.74
Crude Protein (g/kg)	260.60	260.20	260.90	260.40	260.30	260.30
Ether Extract (g/kg)	36.00	35.90	36.10	36.30	35.50	35.60
Crude fibre (g/kg)	43.50	43.20	43.10	39.50	42.40	41.80
Methionine (g/kg)	4.50	4.50	4.50	4.50	4.50	4.50
Lysine (g/kg)	13.50	15.00	16.10	13.50	15.00	16.10
Calcium (g/kg)	10.20	10.20	9.10	10.20	9.60	9.60
Phosphorus (g/kg)	7.00	7.10	6.70	6.90	6.90	6.90

Premix composition to provide the following per kg of diet; vitamin A – 15,000.00,lu Vitamin D3 - 3, 000,000lu, Vitamin E- 30,000,lu Vitamin K – 3,000mg Vitamin B1 3000,mg Vitamin B2 6000mg, Vitamin B6 5,000mg, Vitamin Bie 40mg, Biotin 200mg, Niacah-40,000mg, Pantothenic 15,000mg,Folic acid 2,000mg, choline 300,000mg,Iron 60,000mg, manganese 80,000mg, copper 25,000mg,Zinc 80,000mg cobalt 150mg, iodine 500mg, solencien 310mg, Antioxidant 20,000mg.
Note – ME- Metabolisable energy

Results and Discussion

Proximate composition of the experimental diets are shown in Tables 2. The analysed chemical composition of the experimental diets were similar to the calculated values (Tables 1 and 2).

The result on growth performance of locally adapted turkey is shown in Table 3. There was significant ($P<0.05$) energy $\times$ lysine interaction on the daily feed intake and FCR of locally adapted turkeys. The daily feed intake was significantly ($P<0.05$) higher for locally adapted turkeys on 8.4:1 E/Lys ratio. The FCR was significantly ($P<0.05$) higher for locally adapted turkeys on 7.5:1 E/Lys ratio) than on 9:1 E/Lys ratio and 7.8:1 E/Lys ratio respectively. A higher FCR indicates poor utilization of the diet with 7.5:1 E/Lys ratio, hence, the low daily weight gain and final body weight recorded in for 7.5:1 E/Lys ratio in this study.

Table 2: Proximate Composition of Turkey Diets with Varying Energy/Lysine Ratio (4-8 Weeks of Age)

Metabolisable Energy (kcal/kg)	2900			3000		
Lysine levels (g/kg)	13.50	15.00	16.10	13.50	15.00	16.10
Energy/Lysine ratio	9 : 1	8.1 : 1	7.5 : 1	9.3 : 1	8.4 : 1	7.8 : 1
Experimental diets	1	2	3	4	5	6
Dry matter (g/kg)	921.90	925.00	923.70	921.90	915.30	926.30
Crude protein (g/kg)	262.30	261.50	259.70	260.90	261.70	262.60
Crude fibre (g/kg)	35.40	33.60	33.10	34.60	32.00	34.80
Ash (g/kg)	77.50	85.20	90.20	82.10	87.20	81.70
Ether extract (g/kg)	36.70	40.20	29.20	41.50	51.10	53.00
Nitrogen free extract (g/kg)	510.00	504.50	511.50	502.80	483.30	494.20

Values are means of duplicate samples (air dried basis) * - Calculated analysis

Final body weight and daily weight gain were better on 8.4:1 E/Lys ratios with significantly ($P<0.05$) higher daily feed intake. This is indicative of translating higher feed intake into weight gain. The higher daily weight gain and final body weight recorded for poults on 8.4:1 E/Lys ratio in this study can be attributed to higher feed consumption of the diet in agreement with the report of Erenner *et al.* (2003). This result indicated that the NRC (1994) lysine 15.00g/kg level recommended for turkeys of age 4-8 weeks produced better growth performance of locally adapted turkey at a higher energy level; 3000 kcal/kg ME. This supported the assertion of Veldkamp *et al.*, (2005) that dietary energy may be increased above NRC (1994) energy level when dietary lysine levels were adequate to improve feed efficiency.

Table 3: Growth Performance Characteristics of Locally adapted Turkey Fed Varying Dietary Energy/Lysine Ratio at 4 to 8 Weeks of Age

Energy/Lysine Ratio at 4 to 6 Weeks of Age									
Parameters		Lysine (g/kg)	E/Lys	IBW (g/b)	FBW (g/b)	DWG (g/b/d)	DFI (g/b/d)	FCR	Mortality (%)
Diets	1	13.50	9:1	364.2	1112.4	26.72	41.05 ^b	1.54 ^b	0.00
	2	15.00	8.1 : 1	363.0	1050.5	24.55	46.39 ^b	1.89 ^{ab}	0.00
	3	16.10	7.5 : 1	364.7	1023.4	23.52	47.40 ^b	2.01 ^a	8.33
	4	13.50	9.3 : 1	364.7	1066.3	25.05	46.06 ^b	1.84 ^{ab}	4.17
	5	15.00	8.4 : 1	364.0	1205.4	30.05	56.77 ^a	1.89 ^{ab}	4.17
	6	16.10	7.8 : 1	363.0	1132.5	27.48	43.72 ^b	1.59 ^b	0.00
SEM				0.54	21.74	0.76	1.57	0.06	1.57
Mean	E1			363.0	1062.1	24.97	44.95 ^b	1.82	2.78
Sep.	E2			363.6	1134.7	27.54	48.85 ^a	1.78	2.78
P-value	E			0.494	0.0661	0.0658	0.0414	0.6445	1.0000
	Lys			0.182	0.4647	0.4849	0.0117	0.2179	0.8503
	E× Lys			0.089	0.0970	0.1023	0.0242	0.0318	0.2963
	E/LYS	-		0.147	0.1238	0.1290	0.0112	0.0828	0.6634

Means within column with different superscripts are significantly different ($P < 0.05$). E/LYS – Energy/Lysine ratio, LYS – Lysine Levels, IBW – Initial Body Weight, FBW – Final Body Weight, DFI – Daily Feed Intake, FCR - Feed Conversion Ratio, SEM – Standard Error of Means.

The result on Nutrient Digestibility of locally adapted turkey is presented in Table 4. There was significant ($P < 0.05$) effect of energy/lysine ratio on crude fibre (%) digestibility and, energy $\times$ lysine interaction on the dry matter (%), crude protein (%) and crude fibre (%) of locally adapted turkeys in this study. The result is in agreement with the significant effect of lysine on performance of male Nicholas turkeys reported by Peñaranda-Ali *et al.* (2010).

Table 4: Nutrient Digestibility of Locally Adapted Turkeys Fed Varying Energy/Lysine Ratio at 4-8 Weeks of Age

Parameters	TRT*	E/Lys ratio	LYS (%)	Dry Matter (%)	Crude Protein (%)	Crude Fibre (%)	Ether Extract (%)	ME (%)
D	Diet 1	9.0:1	1.35	89.00 ^{abc}	86.05 ^{ab}	82.44 ^b	88.71 ^{ab}	83.27
I	Diet 2	8.1:1	1.50	90.22 ^{abc}	88.71 ^a	82.12 ^b	87.89 ^{ab}	83.81
E	Diet 3	7.5:1	1.61	85.34 ^c	73.16 ^c	73.71 ^d	83.93 ^b	81.05
T	Diet 4	9.3:1	1.35	87.17 ^{bc}	76.29 ^{bc}	77.55 ^c	89.80 ^{ab}	83.78
S	Diet 5	8.4:1	1.50	90.65 ^{abc}	86.01 ^{ab}	81.86 ^b	92.31 ^a	84.45
	Diet 6	7.8:1	1.61	92.29 ^a	87.53 ^{ab}	86.90 ^a	93.96 ^a	84.39
P	SEM	-	-	0.3012	2.0528	1.2888	1.1292	0.4620
-	E	-	-	0.1461	0.8204	0.0169	0.0162	0.1200
V	LYS	-	-	0.2826	0.1437	0.1808	0.8275	0.4300
A	E $\times$ LYS	-	-	0.0415	0.0259	0.0003	0.1403	0.3532
L								
U	E:LYS	-	-	0.0817	0.0621	0.0001	0.0853	0.3041
E								

Means within rows with different superscripts are significantly different ($P < 0.05$). *Diets 1 - 3 contained 2900 kcal/kg ME, while Diets 4 - 6 contained 3000 kcal/kg ME

Conclusion

It was concluded that lysine level 15.0 g/kg and energy/lysine ratio 8.4:1 were adequate for optimum growth performance of locally adapted turkeys from 4-8 weeks of age in the tropics.

Recommendation

It is recommended that higher metabolisable energy level (3000 kcal/kg ME) be adopted for raising growing turkey in combination with the NRC, (1994) recommended lysine level to 8 weeks of age.

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