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Assessment of Growth Performance of UDA Lambs FED Graded Levels of Supplemental Methionine and Lysine in a Semi-Arid Environment

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Abstract:
Two Different experiments were conducted to determine the effect of supplemental methionine and lysine on growth performance of Uda lambs. Animals with average live weight of 15-17 kg and less than five months of age were randomly allocated to three dietary treatments each containing graded levels methionine and lysine in a completely randomized experimental design (CRD). The animals were fed diets containing 0 (control), 2 and 4g/kg each of methionine and lysine in separate experiments. Results indicated significant differences (P<0.05) between treatment means for animals fed graded levels of methionine in terms of feed intake and live weight changes. Animals fed diets containing 2g/ kg methionine were better (P <0.05) compared to other treatments in growth performance. However, no significant difference (P > 0.05) was observed between animals fed diets containing graded lysine levels. It was concluded that supplementation of lysine has no impact on growth performance of Uda lambs with optimum methionine supplementation. It was recommended that 2g/kg methionine should be supplemented in the diets of growing Uda sheep.

Keywords: *Methionine, lysine, Performance, Uda lambs, Semi-arid environment*

1. Introduction

Performance of ruminants is influenced by the proportion of nutrients in their feed. Protein and energy are the two major components of feed that influence performance of the growing lambs. Provision of quality protein in the lamb's diet does not only improve performance but also ensures profitable animal production (Khalid *et al.,* 2012). Protein has a fundamental role in the Animal's body. It takes part in tissue formation and maintenance, muscle contraction, nutrient transport, hormone and enzyme synthesis. Rumen microorganisms use food protein to synthesize microbial proteins and when carried through to the abomasum and small intestine the proteins are digested and absorbed, thus rendering the ruminants independent of dietary supplies of indispensable and dispensable amino acids (McDonald *et al*., 1988; Chesworth and Guerin, 1992; Aduku, 2004). However when an animal is at a high rate of production, possibly due to rapid growth or high milk production, the amino acids which can be synthesized by the microbes will be insufficient to meet the needs of the animal. Under this condition, amino acids would be from proteins in the diet (Chesworth and Guerin, 1992; Brooker *et al*., 1995; McDonald *et al*., 1995). When a growing animal is provided with insufficient protein or a particular amino acid, it will tend to store energy as fat rather as protein and the efficiency with which it utilises metabolisable energy will probably be altered (McDonald *et al*., 1995). The microorganisms in the rumen of adult ruminants are capable of synthesizing both essential and non-essential amino acids thus rendering the ruminant animal independent of dietary sources of essential amino acid Aduku (2004). Young ruminants however, do not synthesize amino acids in adequate amounts to meet the entire animal's need for essential amino acids because the rumen and reticulum are undeveloped and it is just like in non ruminant animal. Thus supplementation of certain amino acids will be necessary to ensure intake of all essential amino acid for optimum productivity. It has been reported by Storm and Orskov (1984) that "the order of limiting amino acid in microbial protein for lamb growth in descending order is methionine, lysine, arginine and histidine". Miller (2004) also reported that the first two limiting amino acids in practical diets are methionine and lysine. In view of this, the study intends to find out the effect of supplemental methionine and lysine in the diet of Uda lambs in a semi-arid environment.

2. Materials and Methods

2.1. Experimental Location

The experiments were conducted at Livestock Teaching and Research Farm, Usmanu Danfodiyo University Sokoto. Sokoto is located in the Sudan savannah zone in the extreme North western part of Nigeria, and lies between latitudes 12^0 and 13^0 N and longitudes 4^0 and 6^0 E (Mamman *et al.,* 2000). Sokoto has low humidity and high solar radiation with minimum and maximum temperatures of 13°C and 45^0C respectively reported between January and May, and a mean annual rainfall of less than 1000 mm (Aregheore, 2009). Due to low humidity, Sokoto is well known for livestock production than for any other agricultural productivity.

2.2. Experimental Animals and Their Management

Fifteen intact Uda lambs each were used in each of the experiments. The animals were quarantined for two weeks, dewormed with Banmith II^R (12.5mg / kg body weight), sprayed with Triatic^R against ecto-parasites and their pens disinfected. The animals were also treated against possible bacterial infections with oxytetracycline HCl (a broad spectrum antibiotic) and group fed with cowpea hay and wheat offal before the commencement of the experiment.

2.3. Experimental Design

A completely randomized design was used for the study. Five lambs were allocated to each treatment in each of the experiments; each animal serving as replicate while graded levels of methionine and lysine serves as treatments. Each group was assigned to one treatment diet and fed in the morning for 12 weeks.

2.4. Preparation and Formulation of Experimental Diets

Experimental feed ingredients consist of maize, cowpea husk, rice offal, cowpea hay, salt, bone meal, premix and cotton seed cake (for experiment 2). With different levels of methionine and lysine; the diets were Iso-carloric and Iso-nitrogenous. The levels of methionine and lysine in the diets were at 0 (control), 2 and 4g/kg of diet.

Ingredients	**1 (Control)**	**2 (2g/kg methionine)**	**3 (4g/kg methionine)**
Maize	7.00	7.00	7.00
Cowpea husk	14.50	14.50	14.50
GNC	26.04	26.04	26.04
Rice offal	22.01	22.01	22.01
Cowpea hay	26.95	26.95	26.95
Salt	0.50	0.50	0.50
Bone meal	2.50	2.50	2.50
Premix	0.50	0.50	0.50
Total	**100**	**100**	**100**
Calculated Nutrient contents			
Energy (kcal/kg)	2200	2200	2200
Protein (%)	18.00	18.00	18.00
Fiber (%)	22.67	22.67	22.67
Methionine (%)	0.030	0.030	0.030
lysine	0.025	0.025	0.025
Supplemented Methionine (g/100kg)	0.00	200	400
Total methionine content (g/100kg)	3	203	403

Table 1: Composition of experimental diets for experiment 1

Ingredients	Diet 1	Diet 2	Diet 3
Maize	11.35	11.35	11.35
Cowpea husk	7.40	7.40	7.40
Cotton seed cake[CSC]	58.55	58.55	58.55
Rice offal	0.93	0.93	0.93
Cowpea hay	18.27	18.27	18.27
Salt	0.50	0.50	0.50
Bonemeal	2.50	2.50	2.50
Premix	0.50	0.50	0.50
Total	**100**	**100**	**100**
Calculated nutrient contents			
Crude Protein (%)	18.00	18.00	18.00
Energy (kcal/kg)	2200	2200	2200
Crude Fibre (%)	24.63	24.63	24.63
Methionine (g/100kg)	200	200	200
Lysine (g/100kg)	0.032	0.032	0.032
Supplemental lysine (g/100kg)	0.00	200	400
Total lysine content (g/100kg)	0.032	200.03	400.03

Table 2: Comosition of experimental diets for experiment 2

2.5. Data Collection

Daily feed intake was recorded by subtracting the left over from the actual quantity offered the previous day. The animal's individual weights were recorded at the onset of the study and subsequently on weekly basis throughout the period of the feeding trial.

2.6. Chemical Analysis

Samples of the experimental diets were analyzed for proximate component as outlined by the Association of Official Analytical Chemists (AOAC, 1990).

2.7. Statistical Analysis

The data obtained from the two experiments were subjected to analysis of variance using Statview Statistical Package (SAS, 2002). Where significant differences between means were observed, the LSD was used to separate the means.

3. Results and Discussion

3.1. Proximate Composition of Diets for Experiment 1

The proximate composition of the experimental diets is shown in Table 3.

Parameter	Treatments		
	1 (Control)	2 (2g/kg methionine)	3 (4g/kg methionine)
Dry matter (%)	95.26	95.22	95.15
Crude Protein (%)	18.00	18.1	18.15
Crude Fibre (%)	17.66	17.23	17.10
Ether Extracts (%)	6.67	6.80	6.81
NFE (%)	44.05	44.35	44.39
Ash (%)	8.88	8.73	8.70

Table 3: Proximate composition of experimental diets for Uda lambs fed diets containing graded levels of methionine (%)

Results indicated that Dry Matter (DM), crude fibre and ash contents of the experimental diets slightly decreased from treatment 1 to treatment 3 while crude protein, ether extract and nitrogen free extract contents increased as the level of methionine increased (Table 3). The DM contents of the experimental diets are similar to those reported for most tropical feed stuffs (Aduku, 2004). The slight increase in CP contents from treatment 1 to treatment 3 could be brought by the increase in inclusion level of methionine. However, the crude protein contents of the diets were within the range recommended in small ruminants diet (Muhammad, 2011). The slight decrease in ash contents from treatment 1 to treatment 3 could be brought by the decrease in Crude fibre contents (Table 3). Crude Fibre contains high amounts of silica that might contribute to the ash contents of diets (Ademosun, 1985; Prasad, 2008).

3.2. Proximate Composition of the Experimental Diets for experiment 2

Parameter	Treatments		
	1(Control)	2 (2g/kg lysine)	3(4g/kg lysine)
Dry matter (%)	95.76	96.05	95.56
Crude protein (%)	17.45	17.60	17.79
Crude fibre (%)	27.15	25.89	24.00
Ether extracts (%)	4.97	4.80	3.89
NFE (%)	35.66	34.44	12.67

Table 4: Proximate composition of the experimental diets for Uda lambs fed graded levels of lysine (%)

The Dry Matter (DM) content of the experimental diets varied between 95 and 96.8%. Crude Protein (CP) content increased slightly from treatment 1 to treatment 3, while Crude Fibre (CF) content decreased as the level of lysine increased. Ether extracts, Ash and NFE values decreased from treatment1 to treatment 3. Crude protein content of the experimental diets were within the value of 15 – 18% recommended by ARC (1990) for growing sheep.

3.3. Performance of Growing Animals Fed Graded Levels of Methionine

Performance of growing animals fed graded levels of methionine is shown in table 5

Parameter	Treatments		SEM	
	1 (Control)	**2 (2g/kg methionine)**	**3 (4g/kg methionine)**	
Initial Live Weight (kg)	16.80	16.80	17.00	0.87
Final Live Weight (kg)	19.23^{b}	23.70^{a}	22.70^{a}	0.63
Live Weight Gain (kg)	2.40^{b}	6.86^{a}	5.70^{a}	0.49
Feed Conversion Ratio	2.86^{a}	1.18^{b}	1.63^{b}	0.25
Feed intake (g/day)	666.67^{c}	806.33^{b}	877.67^{a}	18.4
Dry matter intake (g/day)	635.07^{c}	767.23^{b}	835.71^{a}	17.5
Crude protein intake (g/day)	120.00^{c}	140.03^{b}	159.29^{a}	3.33
Crude fibre intake (g/day)	117.73^{b}	138.93^{a}	150.08^{a}	3.18
Ether extracts intake (g/dry)	44.47^{c}	53.78^{b}	58.54^{a}	1.23
Nitrogen free extract intake (g/day)	293.67^{c}	357.61^{b}	389.81^{a}	8.41
Feed Intake as % Body Weight	4.70^{b}	5.40^{a}	5.64^{a}	0.24

Table 5: Performance of Growing Uda Sheep Fed Diets Containing graded Levels of Methionine

Means in the same row with different superscripts are significantly different (P< 0.05)

From the results it could be observed that the average feed intake (g/day) was significantly higher (877.67g/day) (P<0.05) for treatment 3 followed by treatment 2 (806.33g/day) and then treatment 1 (666.67g/day). Daily Dry matter (DM), ether extract (EE), Nitrogen free extract (NFE) and crude protein intakes followed the same pattern. Crude Fibre (CF) Intake was not significant between treatments 2 and 3. Treatment 1 has a significantly lower feed crude fibre intake.

The significantly higher feed intake observed for animals in treatment 2 and 3 could be due to supplementation of methionine. This was because methionine supplementation could improve bioavailability of minerals and increase feeding performance of lambs as observed by Abdelrahman and Abdelrahman (2008). Zhang and Li (2010) also reported that supplementation of methionine could improve growth performance of small ruminants. Increased in CP intake with increase in DM intake could be due to increase in methionine levels from treatment 1 to treatment 3. A similar observation was made by Muhammad *et al.* (2011). Increase in crude fibre intake from T1 to T3 could be partly attributed to increase in feed intake as the animals were fed diets containing the same fibre level (Table 1) and partly because increased protein intake could exert significant increased in feed intake and other nutrients. This was also observed by Ledin (2004), Chesworth (2006) and Muhammad *et al.* (2008). Feed intake as % Body weight increased significantly (P<0.05) with increase in methionine level (Table 6). The values reported for animals in this experiment is higher than those reported for Yankasa sheep by Bibi-Farouk and Osinowo (2006) and for Uda sheep by Aruwayo *et al.* (2007). This could be brought partly by increased feed intake and partly by the increase in body gain with increased in methionine level.

3.4. Performance of Uda Sheep Fed Graded Levels of Lysine.

Parameter	Treatments			SEM
	1 (control)	2(2g/kg lysine)	3(4g/kg lysine)	
Initial body weight (kg)	15.50	15.83	15.50	1.22
Final bodyweight (kg)	22.83	24.00	21.67	0.86
Live weight gain (kg)	7.33	8.17	8.17	0.63
Average daily gain(g/day)	104.76	116.67	116.67	9.03
Feed Conversion Ratio	6.53	6.35	5.95	0.51
Feed intake/day (g)	679.27	721.58	691.70	28.76
Dry matter intake (g/day)	661.93^{b}	798.25^{ab}	906.75^{a}	44.11
Ether extract intake (g/day)	37.87^{a}	35.12^{a}	26.67^{b}	0.99
Crude fibre intake (g/day)	206.86	192.74	197.99	9.24
Crude protein intake (g/day)	116.65^{b}	130.92^{ab}	146.64^{a}	4.81
NFE intake (g/day)	271.71	251.96	259.85	15.37
Feed intake as % body weight	3.36	3.34	3.15	0.14

abc, means in the same row with different superscripts are significantly different ($P < 0.05$)

Table 6: Performance of growing Uda sheep fed graded levels of lysine

Results (Table 6) indicated no significant difference between all the treatments ($P > 0.05$) in terms of feed intake (g/day), crude fibre intake (g/day), NFE intake (g/day), feed intake as % body weight, feed conversion ratio, initial body weight (kg), final body weight (kg), live weight gain (kg), and average daily gain (g/day).

Dry matter intake (g/day) and crude protein intake (g/day) were significantly higher ($P < 0.05$) for animals fed diet containing 4g/kg lysine (treatment 3). However, ether extracts intake was significantly higher for the control diet. Results indicated that feed intake was not affected by lysine supplementation. Han *et al.* (1996) reported no difference in feed intake between treatments when diets containing graded levels of lysine were fed to sheep. Significant increase in dry matter intake and crude protein intake ($P<0.05$) from diet 1 to diet 3 shows that addition of lysine could increase feed intake with no significant changes in live weight. Goodwin (1979) reported that increase in protein beyond a certain level could induce excess excretion of nitrogen that could have been used in growth of body tissues which could have subsequently amount to increase in live weight. Results indicated no significant difference ($P>0.05$) in live weight gain, feed conversion ratio and average daily gain between the treatments. This contradicts the earlier report by Storm and Qoskov (1984), Miller (2004) and Veira *et al.,* (1991) that lysine is a limiting amino acid after methionine. However, Venter (2008) reported that lysine supplementation did not affect feed intake, body weight, milk production, milk fat percentage, milk protein percentage and dry matter intake in ruminants. These differences could be attributed to breed and individual animal differences.

4. Conclusion

It was concluded that 2g/kg methionine inclusion level in the diets of Uda lambs gave the optimum performance. Lysine supplementation has no effect on growth performance of Uda lambs if methionine requirement is met.

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