Performance and carcass evaluation of balami rams finished on diets with varying energy level

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Abstract

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Fattening of farm animals is a way of increasing the rate of meat deposit after maturity. Its effectiveness depends on genetic status of the animal and the diet fed to the animal. In this study, performance and carcass evaluation of balami rams finished on diets with varying energy levels were carried. Forty-eight rams of Balami breed, weighing 20.75 ± 1.50 - 22.50 ± 1.91 kg were randomly allotted to four dietary energy levels (EL): 2.20 Mcal/kg (EL_I), 2.40 Mcal/kg (EL_{II}), 2.60 Mcal/kg (EL_{III}) and 2.80 Mcal/kg (EL_{IV}) for 90 days. The feed intake and daily weight gain of the animals in each treatment were determined and the average recorded. Three Balami rams were randomly selected from each treatment and sacrificed to determine the dressing percentage (DP), carcass weight (CW), fat deposit (FD) and meat yield (MY). Data were analysed using descriptive statistics and ANOVA at $\alpha_{0.05}$. The FBW (kg) of Balami rams in group EL_I , EL_{II} , EL_{III} and EL_{IV} were $41.88.6 \pm 1.97$, 42.12 ± 1.84 , 46.13 ± 1.65 and 52.24 ± 2.50 while the FCR of animals on treatments EL_I (5.3 ± 0.28) and EL_{II} (5.2 ± 0.26) were higher than EL_{III} (4.7 ± 0.82) and EL_{IV} (4.0 ± 0.65). The DP (%) were 54.9, 54.9, 55.8 and 56.1, the FD (%) were 9.00, 9.59, 8.92 and 11.46 and the MY (%) were 75.2, 74.7, 75.5 and 72.0 for rams on EL_I , EL_{II} , EL_{III} and EL_{IV} . The results indicate that, increasing levels of energy improved growth performance and carcass quality of Balami rams. Therefore, higher level of dietary energy (2.80 Mcal/kgDM and 14% CP) could be suggested for optimizing growth performance and meat quality of Balami ram under fattening condition.

Keywords: Balami, dietary energy, fattening, meat quality, dressing percentage, keeping quality

Introduction

Production of more rams and better quality meat are the most important elements of the intensive production systems, for instance, ram contributes to food production, rural employment and gross national product by converting roughages into meat, wool and skin (Abdel-Baset, 2009). However, under the traditional feeding systems without organized inputs, rams achieve 40-50g of average daily gain in the most active phase of growth and are marketed for slaughter at 9-12 months of age weighing 20-22kg

(Karim, 2008). Rams need a high energy ration to assure high productivity and rapid growth (Manso *et al.*, 2006). Higher levels of concentrate produce fatter carcasses than those rams reared on forages up to finishing (Borton *et al.*, 2005). Through intensive systems of management where rams are kept indoors and offered *ad libitum* concentrate and forage, productive performance of rams are improved compared to traditional systems (Mahgoub and Lodge, 1994). The principle of the intensive fattening process is concerned

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with the use of intensive feed ingredients in order to benefit the high rate of development ((Hosseini *et al.*, 2008).

Energy is the major dietary element that is responsible for the different utilization of nutrients which in turn affect the productivity of the animal (Hosseini *et al.*, 2008). The genetic potential of animals can be fully exploited only through accurate evaluation of their nutrient requirement and improved feeding management for growth performance (Mandal *et al.*, 2005). Balami is one of the major breeds in Nigeria, essentially used for fattening programmes but their energy requirements have not been properly studied. Therefore, to optimize the improvement of Balami rams, emphasis on their energy requirements and their response to varying levels of energy rations needs to be evaluated.

Materials and methods

Experimental animals and management

Forty-eight Balami rams of about 12-14 months of age with initial live weight of 17.00 ± 1.87 - 19.38 ± 1.37 kg were used for this study. They were purchased at Akinyele Livestock Market and immediately transferred to the sheep and goat unit of the Teaching and Research Farm, University of Ibadan, where the study was carried out. After arrival, the animals were dewormed for internal parasites, sprayed for external parasites, vaccinated against some diseases predominant in the area and quarantined for 21 days.

After the adaptation period, the animals were neck tagged for identification and were randomly allotted to four dietary treatments (2.20, 2.40, 2.60 and 2.80 Mcal digestible energy/kgDM) with similar levels of crude protein (14%). The composition of the concentrate mix diets is as shown in Table 1. *Panicum maximum* hay was offered as basal diet and the experimental animals had access to the

concentrate basal diets at the ratio of 60:40. The animals were fed at the rate of 5.0 % of their respective body weight on daily basis. Concentrates feeding was twice daily (8:00 a.m. and 3:00 p.m.) while roughages was offered in-between the concentrate. Each animal had free access to water and salt-lick throughout the experiment. Live weight of rams was recorded once weekly, feed offered and refused daily was recorded in all groups. Feed conversion ratio was estimated based on the dry matter intake per kg of live weight gain. Feed intake was determined daily as the difference between feed offered and refusals. The feeding trials (fattening experiment) were carried out for 90 days.

Slaughter procedure

At the end of the feeding exercise, four animals were randomly selected from each of the dietary treatments and transported to the slaughter house of the Department of Animal Science, University of Ibadan. The animals were fasted for 16-hours with free access to water and weighed immediately prior to slaughter. A humane slaughter method was used, an incision was made on the jugular furrow at the occipito-atlantal junction close to the head, severing both the carotid arteries, jugular veins, trachea, oesophagus and the spinal cord. The head was removed, the carcass was skinned and eviscerated. The carcass components were weighed and recorded using an electronic scale (Cuisinart KML-K03BV36246-China) and dressing percentage was calculated from the ratio of hot carcass weight to slaughter weight.

The carcass was then split along the mid line and the right half carcass was randomly selected and dissected into seven wholesale cuts according to AUS-MEAT (1998): hindleg, foreleg, neck, brisket, rack, loin and flank. Each cut was further dissected into components of lean meat, fat, bone and trimmings. The four components were

weighed separately, then multiplied by two to determine their relative proportions to

the cold carcass weight (CCW). The percent composition of the cuts was calculated as a proportion of the hot carcass weight.

Table 1: Gross composition of experimental diets used for ram (Balami) fattening (g/100g DM)

Ingredient (%)	Treatments (Digestible Energy Mcal/kgDM)			
	I(2.2)	II(2.4)	III(2.6)	IV(2.8)
Cassava peel	5.69	6.94	7.56	8.16
Wheat offal	19.56	23.86	26.00	28.05
Dusa*	30.38	27.55	26.15	24.80
Brewed dried grains	29.38	26.65	25.29	23.99
Palm kernel cake	10.00	10.00	10.00	10.00
Dicalcium phosphate	3.00	3.00	3.00	3.00
Common salt	1.00	1.00	1.00	1.00
Grower premix	1.00	1.00	1.00	1.00
<i>Calculated nutrient content</i>				
Crude protein	14.00	14.00	14.00	14.00
Ether extract	5.30	5.16	5.09	5.05
Crude fibre	13.71	13.30	13.11	13.00
Digestible energy (Kcal/kgDM)	2200	2400	2600	2800

Table 2: Chemical composition of experimental diets (dry matter basis %)

Parameters	I(2.2)	II(2.4)	III(2.6)	IV(2.8)	Hay
Dry Matter	94.78	93.75	93.85	93.75	94.04
Crude Protein	12.76	12.93	13.02	13.03	6.98
Ether Extract	4.32	4.83	4.71	4.76	6.97
Ash	4.20	4.69	4.73	4.73	8.17
Crude Fibre	12.75	13.6	17.80	18.1	20.80
Acid Detergent Fibre	47.00	48.00	40.00	38.00	35.00
Acid Detergent Lignin	25.00	23.00	21.00	22.00	14.00
Neutral Detergent Fibre	65.00	64.00	57.00	54.00	60.00
Cellulose	22.00	25.00	19.00	16.00	21.00
Hemicellulose	18.00	16.00	17.00	16.00	25.00
Nitrogen free extract	55.96	57.70	53.29	53.43	51.48
Metabolizable energy (Kcal/kgDM)	3489.54	3628.07	3838.25	4090.43	3884.10

Chemical composition

The chemical composition of the feed dry matter (DM) and nitrogen (N) (using the micro-Kjeldahl procedure) were determined according to AOAC (1990) and the neutral detergent fibre (NDF), acid detergent fibre (ADF) and acid detergent lignin (ADL) of the feeds were analyzed according to Van Soest *et al.* (1991).

Statistical analysis

Data obtained were subjected to analysis of variance and where statistical significance were observed, least significant difference (LSD) was used to differentiate between

means. The SAS computer software package (SAS, 2001) was used for all statistical analysis.

Results and discussion

Performance characteristics of fattened rams

The performance characteristics of fattened Balami rams presented in Table 3 showed the differences in final live weight of rams between the individual groups on the different dietary energy levels were significant ($P < 0.05$). The final live weight of rams were 41.88 kg, 42.12 kg, 46.13 and

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52.24 while the average daily weight gain (ADWG) were 231.00g, 237.50g, 274.50g and 325.00g for rams on dietary energy levels of EL_I, EL_{II}, EL_{III} and EL_{IV} respectively. There were significant differences in the average daily weight gain of the animals from the different dietary energy levels ($P = 0.05$). Increasing the energy level may allow the production of rumen microorganisms resulting in a rise in the synthesis of microbial protein and in the amount of protein available to the animal. The variation observed in the weight gain (g/day) of the rams could be attributed to the variation in the chemical constituents of the diets which seems to have an effect on the feed intake of the experimental animals. Ram growth rate, at a given age, is a function of feed intake rather than time

(Butterfeld, 1988). However, lower values were observed (up to 200 g/day) for tropical sheep fed with high-energy rations (Kawas *et al.*, 2007). Feed conversion ratio is a trait of economic importance because it is this value that will show whether the animals were able to utilise the feed given to them effectively. From the results it was observed that animals on dietary EL_{IV} had the best feed conversion ratio (4.04) followed by 4.70, 5.22 and 5.27 for animals on dietary EL_{III}, dietary EL_{II} and EL_I, respectively. Higher values (between 8 and 12) were obtained by Mahgoub *et al.* (2005) with Omani lambs, whose ration consisted of 60% forage (Madhavi *et al.*, 2006) with Nellore lambs fed neem seed cake based complete diets and Wildeus *et al.* (2007) with hair sheep fed 100 % alfalfa hay.

Table 3: Performance characteristics of fattened balami rams at different dietary energy levels

	Treatments (Digestible Energy Mcal/kgDM)				Pvalue
	I(2.2)	II(2.4)	III(2.6)	IV(2.8)	
Number of Ram	12	12	12	12	-----
Initial Live weight	20.75±1.50	20.50±1.00	21.50±1.00	22.50±1.91	0.2342
Final Body Weight	42.12±1.84 ^c	41.88±1.97 ^c	46.13±1.65 ^b	52.24±2.50 ^a	0.0001
Average Daily Weight Gain	231.00±1.18 ^c	237.50±1.84 ^c	274.50±0.02 ^b	325.00±0.01 ^a	0.0001
Daily Feed Intake/Head	1.09±0.16 ^a	0.73±0.08 ^b	0.78±0.09 ^b	0.81±0.02 ^b	0.0011
Daily Dry matter Intake/Head	1.00±0.16 ^a	0.64±0.08 ^b	0.68±0.08 ^b	0.71±0.02 ^b	0.0010
Feed Conversion Ratio	5.27±0.80 ^b	5.22±0.66 ^{ab}	4.70±0.48 ^b	4.04±0.17 ^a	0.0001
Metabolic Body Weight ^(0.75)	16.53±0.54 ^c	16.46±0.58 ^{ab}	17.70±0.48 ^b	19.43±0.70 ^a	0.0478

^{a,b,c}: Means with different superscripts in the same row are significantly different ($P < 0.05$).

Carcass characteristics and wholesale cuts

Carcass characteristics of the animals showed that the the bled weight ranged from 92.01 to 95.18% while the empty body weight ranged from 61.19% to 64.20% (Table 4). Although there was no significant difference ($P > 0.05$) between the values, but numerically, it was observed that the bled weight increased as the dietary energy increased. The hot carcass weight (28.48kg) of animals on EL_{IV} was significantly higher ($P < 0.05$) than 24.67kg,

22.91kg and 23.17kg for animals on EL_{III}, EL_{II} and EL_I, respectively. There were no significant differences ($P > 0.05$) in the dressing percentage (DP) of the animals and it ranged from 54.90 to 56.08% and falls within the range 46-56% reported by Zimmerman *et al.* (2008) in Creole kids. The values of some of the characteristics measured in this study are slightly higher than those reported by Momani Shaker *et al.* (1997) who reported an average slaughter weight of 42.kg, average carcass weight of 21.96 kg and average dressing percentage

of 52.45kg for pure Charollais rams reared in warm condition. The high DP obtained in

this study indicated that there is a good profit margin for the farmer in the retail market.

Table 4: Carcass characteristics (relative to live weight) of Balami rams fattened at different dietary energy levels (Mcal/kgDM)

Parameters (kg)	I (2.2)	II (2.4)	III (2.6)	IV (2.8)
Fasted body weight	41.17±2.25 ^{bc}	40.33±2.47 ^c	44.50±1.80 ^b	50.83±2.25 ^a
Bled weight	93.29±0.45 ^{ab}	92.01±0.28 ^b	94.21±1.32 ^a	95.18±1.67 ^a
Empty body weight	61.73±3.05	62.22±1.53	61.19±1.88	64.24±3.15
Chilled carcass weight	95.63±0.38 ^c	96.72±1.15 ^{bc}	97.93±0.11 ^b	99.30±0.61 ^a
Chilling loss (%)	4.37±0.38 ^a	4.11±0.45 ^a	2.07±0.11 ^b	0.58±0.52 ^c
Hot carcass weight	23.17±1.76 ^b	22.91±1.28 ^b	24.67±2.08 ^b	28.48±1.29 ^a
Dressing percentage (%)	54.90±1.22	54.92±0.39	55.77±1.06	56.08±1.52

^{a,b,c}: Means with different superscripts in the same row are significantly different (P<0.05).

Distribution of tissues

As growth continues, the ratio of bone to carcass weight decreases while muscle ratio increases, and thus the muscle to bone ratio increases with an increase in carcass weight. As maturity is reached, the percentage of muscle to carcass weight will start to decrease as the percentage of fat starts to increase (fattening phase) (Roy *et al.*, 2005).

The tissue distribution values were meat (75.17, 74.67, 75.55 and 72.00 %), bone (14.44, 14.52, 14.11 and 14.91 %) and fat

(9.00, 9.59, 8.92 and 11.86 %) for Balami rams on EL_I, EL_{II}, EL_{III} and EL_{IV}, respectively. The relatively close meat-to-bone ratio of rams in this study indicated that there was uniform rate of meat and bone deposition in the experimental rams which support the report of Ewnetu *et al.* (2006) that observed significant differences in meat-to-bone ratio in Menz and Horro sheep. However, Krishna *et al.* (1983) reported no significant effect in the proportion of meat-to-bone ratio among lambs fed complete rations.

Table 5: Distribution of tissues of Balami rams carcass fed different dietary energy levels (% hot carcass weight)

Parameters (%)	Treatments (Digestible Energy Mcal/kgDM)				Pvalue
	1(2.2)	2(2.400)	3(2600)	4(2800)	
Meat	75.17±0.73 ^a	74.67±1.51 ^a	75.55±4.09 ^a	72.00±7.33 ^b	0.0164
Bone	14.44±0.23 ^{ab}	14.52±0.74 ^{ab}	14.11±2.68 ^b	14.91±2.24 ^a	0.0984
Fat	9.00±0.48 ^b	9.59±1.71 ^b	8.92±1.88 ^b	11.46±4.74 ^a	0.0009
Losses	1.25±0.21	1.07±0.84	1.16±0.62	1.47±0.18	0.4584
Meat : Bone	5.22±0.06 ^a	5.14±0.12 ^{ab}	5.32±0.55 ^a	4.84±0.52 ^b	0.0719
Meat : Fat	8.42±0.23 ^a	7.79±0.61 ^a	8.52±0.38 ^a	6.09±1.34 ^b	0.0037

^{a,b,c}: Means with different superscripts in the same row are significantly different (p<0.05).

Conclusion

The results of the present study showed that high energy based diet has positive effects on fattening performance of rams. Balami

rams have better feed conversion when a concentrate is used. It can be inferred from this study that fattening of Balami rams under feedlot system for a period of 90 days

with optimum dietary energy levels of 2.60 and 2.8 Mcal/kg DM; 14% CP will give rise to animals with good growth performances, carcass and quality meat yield. The feed resources used in this study are locally available and their use will greatly increase meat production for the export and domestic market.

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