Effect of Different Dietary Energy Levels on the Performance and Nutrient Digestibility of Lambs

Abdel-Baset N. Sayed

Department of Animal and Clinical Nutrition
Faculty of Veterinary Medicine, Assiut University, P.O. Box 71526, Assiut, EGYPT
Phone: +20882411698, Mobile: +20101657386, Fax: +2088366503
E. Mail: Baset61@yahoo.com

Abstract

Sixty male lambs were used in this experiment to study the effect of energy level of diets on the performance, nutrient digestibility and carcass traits for 90 days. The animals were allotted into 3 groups, 4 animals per each. The first group was fed a medium energy diet (3.20 Mcal/kg diet), while the second group fed on diet contained high energy level (3.50 Mcal/kg diet) and the third group fed on low energy diet (2.90 Mcal/kg diet). All diets contained 14.70% crude protein in dry matter. The average daily feed intake was affected significantly ($P < 0.05$) by the level of energy and lambs group fed on low energy ration had significantly ($P < 0.05$) increased feed intake compared with other treatment groups. Lambs that received the highest energy level diet had a higher significant ($P < 0.05$) average daily gain than that received the medium and low energy diets. Feed conversion was deteriorated in lambs group fed on low energy diet. The digestion coefficient of nutrients and total digestible nutrient were increased significantly ($P < 0.05$) with high-energy diet. Dressing percentage and body fat was increased with feeding high dietary energy. It could be concluded that the high dietary energy produced the best performance, nutrient digestibility and carcass traits of lambs in addition to economical benefit.

Keywords: Energy, Performance, Digestibility, Carcass, Lambs

Introduction

Small ruminant especially sheep are growing in importance for animal production. The proper growth and development of growing lambs and kids depends heavily on the animal's level of nutrition. The primary principle of the intensive lamb fattening process is concerned with the use of intensive feed ingredients in order to benefit the high rate of development in the lambs early ages. Energy is the major dietary element that is responsible for the different utilization of nutrients and thereby the productivity and gain of an animal (Hosseini et al., 2008). Inadequate nutrition, particularly of energy, depressed the reproductive performance of intensively managed sheep. Good feeding advances sexual maturity of sheep and goats and the energy stimulate estrus activity within the normal breeding season, ovulation rate, fertilization and survival of ova and the maintenance of the resultant embryos to term as viable lamb. In general, average daily gain increased and feed efficiency was improved as protein and energy levels in the diet were increased (Ebrahimi et al., 2007).

A number of factors affecting growth performance, the quality and quantity of the carcass, as well as productivity in sheep marketing, of which the dietary energy and protein levels and their interaction are probably the most important (Haddad et al., 2001 and Bellof & Pallauf, 2004).

Materials and Methods

Animals: Sixty male lambs (initial weight 30±1.2 kg and 6 months) were randomly distributed into four groups (4 lamb / group). Each lamb was kept in an individual cage. A daily ration was offered to each animal in its respective feed trough and tap water freely available.

Diets & measurements: The medium energy's diet was formulated to contain the recommended levels of digestible energy (DE) 3.20 Mcal/kg, crude protein (CP) 14.7% according to the NRC (1981) for sheep. The 2 different energy levels as treatments (HE = 3.50 Mcal/kg, low energy, LE= 2.90 Mcal/kg diet). The lambs were adapted each diet for 10 days and used over period of 90 days. All diets contained 14.70% crude protein in dry matter (Table 1). Data was collected every week on live weight gain and feed consumption. These were used to compute the average daily gain, average daily feed intake and feed conversion.

Digestibility trials: A digestion trial was conducted for 7 days at the end of the experiment to assess the

Table-1. Composition (%) of the experimental rations

Items	Treatment		
	ME[1]	HE	LE
White corn	36.00	42.80	37.42
Soybean meal	18.57	17.60	18.48
Dried fat	8.83	13.80	1.50
Wheat straw	35.47	25.00	41.00
Limestone, ground	0.33	0.00	0.80
Common salt	0.50	0.50	0.50
Premix	0.30	0.30	0.30
Total	100	100	100
Chemical composition			
DM	89.29	89.54	88.81
CP	14.72	14.71	14.70
Calcium	0.52	0.50	0.51
Phosphorus	0.32	0.34	0.30
DE (Mcal/kg diet)	3.20	3.50	2.90

1 ME = medium energy, HE = high energy, LE = low energy

utilization of different dietary nutrients. During this period, animals were fed a fixed weight of ration. Representative feed and fecal samples collected over the period of 7 days were subjected to chemical analysis according to AOAC (1990).

Carcass traits: At the end of the experiment, 3 animals were selected from each of the treatments and starved for 24 hours, while water was provide ad libitum. Live weights at slaughter, dressed carcass, edible organs and body fat weight were recorded.

Economical efficiency: Economical efficiency was calculated as the ratio between income (price of weight gain) and the cost of feed consumed.

Statistical analysis: All data were subjected to statistical analysis (SAS, 1990). Duncan's (1955) multiple range test were utilized to detect differences among groups.

Results

The performance of lambs fed on the different experimental diets is presented in Table (2). The feed intake was higher for group fed on low energy diet compared with other treatment groups. The weight gain of the lambs fed on high-energy diet was increased by 31.60%, while those fed on low energy diet was decreased by 19.87%. The feed conversion was better in the group fed on high energy compared to other experimental groups. High energy content had more effect on live weight at slaughter, dressing percentage, weights of internal organs and body fat weight compared to other experimental groups. Data in Table (3) revealed that diet containing high energy improved digestion coefficients of dry matter by (6.15%), crude protein (5.66%), crude fiber (11.93%), ether extract (8.91%) and nitrogen-free extract (4.24%) respectively.

The economical evaluations of the different experimental groups are presented in Table (4). The high-energy diet was recorded the highest values in net revenue and economic feed efficiency (115.76 LE, 43.23%) in comparison with other treated groups.

Discussion

The level of energy was affected significantly ($P < 0.05$) on average daily feed intake and lambs group fed on low energy ration was consumed more ration compared with other treatment groups as shown in Table (2). This agreed with that reported by Hossain et al. (2003) and Yagoub & Babiker (2008). There were significant ($P < 0.05$) differences in the average daily gains between different experimental groups. Lambs that fed on ration contained high energy level recorded higher significant ($P<0.05$) average daily gain than that of medium and low energy diets. This finding agreed with that reported by Ebrahimi et al. (2007). Average daily gain was highest in goat kids fed high-energy diet and lowest in goats fed low energy diet (Hossain et al., 2003). Increasing the energy level may be allows the production of more fermentable ME for rumen microorganisms resulting in a rise in the synthesis of microbial protein and in the amount of protein available to the animal. Feed conversion was decreased in lambs group fed on low energy diet; here the decrease in growth rate and live weight attained could be the reason. This agreed with that reported by Ebrahimi et al. (2007) and Hossain et al. (2003).

Dressing percentage was increased with increase of fatness and this is associated with feeding high dietary energy. These results are in agreement with Hosseini et. al. (2008) fed high energy diets to lambs and found more rapid fat deposition than those fed a roughage diet.

It was obvious from the obtained results in Table 3, that digestibility of nutrients was significantly ($P<0.05$) increased with lambs group fed on high energy diet, while the low energy diet was decreased. This results agreed with that found by Hossain et al. (2003). There were significant ($P<0.05$) differences in the total digestible nutrients and high-energy diet recorded the highest value compared with other treatments. However, there was non-significant effect on the digestible crude protein between different experimental diets.

The economical efficiency was higher for lambs fed on high-energy diet compared with other treated groups. It could be concluded that increasing energy levels in lamb's diet resulted in increasing growth performance, nutrient digestibility and carcass traits of lambs.

References

1. A.O.A.C. (1990): Official Methods of Analysis. 13th Ed

Table-2. Performance of lamb under different treatments

Items	Treatment		
	ME	HE	LE
Av. daily gain (gm)	215.89±7.15 b	284.11±8.22 a	180.11±5.30 c
Av. daily feed intake (gm)	1351±8.05 b	1305±7.63 c	1465±8.15 a
Feed conversion	6.26±0.08 b	4.59±0.05 a	8.13±0.03 c
Dressed carcass (kg)	26.30±1.03 a	27.08±1.10 a	19.45±1.02 b
Dressing (%)	56.87±0.03 a	56.98±0.01 a	51.22±0.05 b
Heart (%)	0.95±0.04 b	0.99±0.01 a	0.91±0.07 c
Kidneys (%)	0.53±0.05 a	0.51±0.04 a	0.46±0.01 b
Liver (%)	3.16±0.10 b	3.43±0.35 a	2.98±0.15 b
Lungs (%)	2.21±0.05 b	2.29±0.10 a	2.17±0.13 b
Abdominal fat (kg)	0.56±0.04 b	0.62±0.05 a	0.29±0.01 c

*Figures in the same row having the same superscripts are not significantly different (P<0.05)

Table-3. Digestibility and nutritive value of different treatment

Items	Treatment		
	ME	HE	LE
Apparent digestibility (%)			
DM	64.22±1.20 b	68.17±1.10 a	56.22±1.01 c
CP	67.31±0.90 b	71.12±0.73 a	60.50±0.86 c
CF	40.50±1.10 b	45.33±1.08 a	34.87±1.02 c
EE	70.24±1.55 b	76.50±1.90 a	65.21±1.03 c
NFE	77.35±1.07 b	80.63±1.44 a	74.73±1.56 c
Nutritive value			
DCP	12.05±1.65	12.28±1.46	11.72±1.10
TDN	83.81±2.03 b	91.35±2.10 a	80.55±2.15 b

Association of Analytical Chemists. Washington, DC.
2. Bellof, G. and Pallauf, J. (2004): Deposition of protein, fat and energy in lambs of the breed German Merino Land sheep. *Anim. Sci.,* 78(3): 369-378.
3. Duncan, D.B. (1955): Multiple Range and Multiple F test. *Biometric,* 11:1-42.
4. Ebrahimi, R., et.al.(2007): Effect of energy and protein levels on feedlot performance and carcass characteristics of Mehraban ram lambs. *Pak. J. Biol. Sci.,* 15(10): 1679-1684.
5. Haddad, S.G.; Nasr, R.E. and Muwalla, M.M. (2001): Optimum dietary crude protein level for finishing Awassi Lamb. Small Rum. Res., 39(1): 41-46.
6. Hossain, M.E; Shahjalal, M.; Khan, M.J. and Hasanat, M.S. (2003): Effect of dietary energy supplementation on feed intake, growth and reproductive performance of goats under grazing condition. *Pak. J. of Nutr.*, 2(3): 159-163.
7. Hosseini, S.M., et.al. (2008): Effect of different energy levels of diet on feed efficiency, growth rate and carcass characteristics of fattening lambs. *J. of Anim. & Vet Adv.*, 7(12): 1551-1554.
8. NRC, National Research Council (1981): Nutrient requirements of sheep. National Academy Press, Washington, D.C.
9. SAS (1990): SAS/STAT. "Guide for personal computers" SAS Inst., Inc., Cary, NC, USA.
10. Yagoub, Y.M. and Babiker, S.A. (2008): Effect of dietary energy level on growth and carcass characteristics of female goats in Sudan. *J. Anim. Sci.*, 80: 100-115.

Table-4. Economical evaluation of lamb for different treatments

Items	Treatment		
	ME	HE	LE
Total feed cost (L.E)	228.59	267.79	176.68
Body weight gain (Kg)	19.43	25.57	16.21
Price of body weight gain (L.E) *	291.45	383.55	243.15
Net revenue (L.E)	62.86	115.76	66.47
Economic feed efficiency (%)	27.50	43.23	37.62
Relative economic feed efficiency (%)	100	157.20	136.80

* L.E = Egyptian Pound

* * * * * * * *