INTERNATIONAL JOURNAL OF AGRICULTURE & BIOLOGY
1560–8530/2006/08–6–721–723
http://www.fspublishers.org

Effect of Different Levels of Digestible Undegradable Protein on the Fattening Performance of Kermani Male Lambs

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ABSTRACT

The influence of three levels of digestible undegradable protein, 19.86 (group 1), 26.47 (group 2) and 33.08 (group 3) (g kg^{-1} DM) on the performance of Kermani male lamb breed was investigated. Thirty six lambs aged 6-7 months with an initial live weight of 29±2.5 kg were used. The animals were fed for a period of 95 days. The level of metabolisable energy, 10.5 MJ kg^{-1} DM, was similar in all the groups. Dry matter intake (DMI) was measured daily and live weight gain (LWG) was determined fortnightly. The data were statistically analyzed using completely randomized design with 3 diets (n=12). Mean values for the performance of the lambs for 1, 2 and 3 groups were as follows: LWG 173.2, 200.8 and 210.4 g day^{-1} (S.E. 5.8, $P<0.05$); DMI 1480, 1510 and 1600 g/day (S.E. 0.019 $P<0.05$); feed conversion efficiency 8.54, 7.39 and 7.58 (S.E. 0.19, $P<0.05$). The results showed that the group which contained 26.47 g digestible undegradable protein (g kg^{-1} DM) was economically viable (group 2 in comparsion to group 3 and 1 has higher profit, 16979 and 32317 Rials, respectively).

Key Words: Digestible Undegradable Protein; Fattening Performance; Kermani Male Lambs

INTRODUCTION

About fifty million sheep with more than twenty breeds are bred in Iran and makeup 33% of our consumed meat (Tavakoli, 1998). The main aim of producing livestock is to obtain highest amount of muscular tissue with the least cost of feed and minimal level of fat in the carcasses. Unsuitable feed and low level of native breed are responsible for the low sheep meat production in Iran (Tavakoli, 1998). It is for a long time that crude protein is given being to the livestock to maintain the protein requirement of animals. But the new methods of evaluating the feed show that crude protein is not enough to describe protein influence on the growth and animal function. So the protein requirements of the ruminants are not completely provided (McDonald *et al*., 1995). In order to improve protein uptake of animals, feed should be divided into its ingredients and the proportion which is digested in rumen and the proportion which is not digested and reaches small intestine, should be identified. Rumen Degradable Protein (RDP) is not capable of providing protein requirements for high level of meat and wool production (McDonald *et al*., 1995). Therefore Undegradable Dietary Protein (UDP) is necessary to provide amino acid requirements for potential growth of these kinds of animals. Based on reported information, there are about 2.4 millions *Kermani* sheep in Kerman (Moradi Shahrbabak *et al*., 2002). This breed is important mainly because of high number having small fat tail and high level of meat and wool which is particularly important for carpet weaving.

MATERIALS AND METHODS

Thirty six Kermani male lambs in Shahrbabak city were selected randomly with an initial live weight of 29±2.5 Kg and the age of about 6-7 months. Three levels of digestible undegradable protein (DUP), 19.86 (1), 26.47 (2) and 33.08 (3) (g kg^{-1} DM), and one level of metabolisable energy (10.5 MJ kg^{-1} DM) based on the standard tables of male lamb feed of Agricultural and Food Research Council (AFRC) (1) (Table II & III) were used. Experimental groups and their ingredients are shown in Table I. Grass materials were mixed with the protein concentrate. The wool of lambs was sheared and vaccinated against current diseases (Enterotoxemia – Anthrax and Pox, all of the injected subcutaneous) and anti-parasite drug (Albendazole) was given to the lambs before the experiment. The animals were weighed and placed in different groups based on the. Animal were fed four times a day for a period of 95 days (14 days for adaptation and 81 days for period of trial). The remained feed was collected and weighed in order to measure the daily feed intake. Dry matter intake (DMI) was measured daily and the live weight gain (LWG) was determined fortnightly (after 12-16 hours of fasting individually). At the end of the trial, 50% of the animals were slaughtered (by humane method) to characterize the carcass quality. The data were statistically analyzed using

Table I. Percentage of Ingredients in the rations (on dry matter basis) fed to groups 1, 2 and 3 of Kermani lambs

Feed Ingredient rations	Group 1*	Group 2*	Group 3*
Alfa-Alfa (%)	3	20	13
Wheat straw (%)	17.8	10	7.4
Barley (%)	53	53.4	49.3
Bran (%)	26	9	10
Cottonseed meal (%)	-	7.6	20.3
Limestone (%)	0.2	-	-
Total (%)	100	100	100

*Groups 1-2-3 are containing 19.86, 26.47 and 33.08g (DUP) respectively

completely randomized design with 3 diets (n=12) (9). The model is according to the following equation:

$Y_{ij} = \mu + t_i + \beta x_{ij} + e_{ij}$

Where Y_{ij} is the record for jth replication and ith diets, μ: the total mean, t_i: the effect of ith diets, x_{ij}: the covariate of initial weight, β: regression coefficient final weight on initial weight , I=1,..,3(the number of diets), J=1,…,12 (the number of replication) and e_{ij} is the residual effect

RESULTS AND DISCUSSION

Fattening characteristics. The means related to the increased live weight gain, dry matter intake and feed conversion efficiency in experimental groups 1, 2 and 3 are reported in Table IV.

Dry Matter Intake (DMI). There is a significant differences (P<0.05) between dry matter intake average in different experimental groups (Table II). The increase of digestible undegradable protein from 19.86 g (group 1) to 26.47g (group 2) has had a significant increase in the DIM (P<0.05). But the DUP level 33.08 g (group 3) in proportion to the 26.47g DUP (group 2) has not had a significant influence on the DIM (P<0.05). The upper amount of DIM in group 2 and group 3 compared to group 1 is provided because of the desirable condition of fermentation in rumen. This is possibly because of the increase of digestibility, increased digestion of cellulose that causes the faster passing of the feed from rumen to small intestine (McDonald *et al*., 1995). However, there is a positive correlation between ration digestion capability and the animal feed intake, so together with the increase of ration digestibility, DIM increases (Ørskov, 1992). Obtained results (the positive relation between DMI and DUP) in the recent study are in agreement with the findings of Farahpour (2002) while disagreement with those of Al Jassim *et al*. (1991). This can be due to the low level of DUP (8.29 g kg^{-1} DM) enough for desirable fermentation in the rumen.

Live Weight Gain (LWG). The results related to the live weight gain of lambs during the whole period for 3 experimental groups are given in Table II. With the increase in DUP level in the ration, the LWG also increased. The highest average LWG was found in the lambs with group 3 (210.4 g d^{-1}) and the least in those with group 1 (173.2 g d^{-1}). There was no significant difference (P<0.05) between the LWG values of group 2 and group 3 fed with 200.8 g d^{-1} and 210.4 g d^{-1} ration. It is possible that the LWG is related to increasing of DUP that causes the increasing of original amino acids density and their absorption in small intestine that improve the animal power and ability afterwards (Church, 1988). On the other hand, groups 2 and 3 have received more metabolic energy because of DIM (increased production of free fatty acid in rumen) and DUP causing more LWG in proportion to group 1. It seems that the cause of no significant difference between groups 2 and 3 is related to the high power productive lambs of this breed in the recommended AFRC (1995) (group 2). Obtained results are in agreement with those obtained of Al Jassim (1991) and Farahpour (2002) while disagreement with Sinclair *et al.* (1991). This can be assumed that the low level of DUP may be the cause of non-significant daily weight gain.

Table II. Chemical analysis of various rations (%)

Ingredient feed	DM	CP	EE	ASH	ADF	NDF	ADIN (g kg^{-1} DM)	Ca	P
Alfa-Alfa	90.77	15.2	3.48	11.18	22.55	27.43	0.263	1.06	0.16
Wheat straw	94.42	4.02	2.03	18.1	47.91	63	0.069	0.38	0.07
Barely	92.57	11.07	3.09	3.19	8.78	25.44	0.023	0.66	0.35
Bran	89.75	14.97	4.51	5.92	13.14	36.96	0.104	0.087	0.84
Cotton seed meal	96.52	25.96	6.31	4.75	35.92	48.34	0.201	0.091	0.55

(DM: Dry Matter, CP: Crude Protein, EE: Ether Extract, ASH: Ash, ADF: Acid Detergent Fiber, NDF: Non Digestible Fiber, ADIN: Acid Detergent Insoluble Nitrogen, Ca: Calcium, P: Phosphorous)

Feed Conversion Efficiency (FCE). The results show that different levels of DUP in feed group had a significant (P<0.05) influence on feed conversion efficiency (FCE) of the lambs (Table IV). The economic FCE is related to group 2 and the highest is to group 1 and no significant difference has been between 2 and 3 groups. Possibly the improvement of FCE of groups 2 and 3 groups, caused the better LWG. In a recent study it has been reported that protein supplementary feeding had positive influence on the FCF and increasing protein ration will increase the amount of protein in small intestine that result to the better animal performance (Schaefer *et al*., 1985). Obtained results are disagreement with those obtained by Hussein and Jordan (1991). This can be due to the daily increase in LWG and not increasing of DMI.

Economic Survey. The main purpose in animal fattening is to get the most muscle tissue growth with the least feed cost and avoiding additional fat storage in carcass. The cost of each protein unit is more than other nutrients and should be given to the animal in the optimal limit. The cost of feed rations has been defined in proportion to nutrients making up rations and considering their current price and then the needed feed expense for one kg of LWG has been calculated separately for different groups.(The calculated expenses have just been those of feed and those of personal, capital amortization and installation have not been calculated). According to these calculations, feed intake cost for the production of one kg of LWG for groups 1, 2 and 3 were 7335, 6695 and 7930, respectively. The sale amount of

Table III. Energy and nutrient composition of various rations

Nutrient and energy of ration	Group 1	Group 2	Group 3
ME ($MJKg^{-1}$ DM)	10.5	10.5	10.5
FME ($MJKg^{-1}$ DM)	9.74	9.74	9.75
CP (%)	10.93	12.67	14.49
ERDP(%)	8.7	8.91	8.95
ERDP: FME	8.9	9.18	9.2
DUP (%)	1.986	2.647	3.308
MP (%)	7.35	8.37	9.7
Ca (%)	0.67	0.61	0.52
P (%)	0.42	0.34	0.39

(ME: Metaboliseble Energy, FME: Fermentable Metabolisable Energy, CP: Crude Protein, ERDP: Effective Rumen Degradable Protein, DUP: Digestible Undegradable Protein, MP: Metaboliseble Protein, Ca: Calcium, P: Phosphorous)

Table IV. The mean of performance fattening traits of Kermani male lambs

Traits	SE **	Group 1	Group 2	Group 3	Means ± SE
ILW (Kg)	0.21	28.5 [a]	29.2 [a]	29.4 [a]	29.045±1.3
FLW (Kg)	0.598	45.2 [b]	48.3 [a]	49.4 [a]	47.61±3.5
LWG (gd^{-1})	5.803	173.2 [b]	200.8 [a]	210.4 [a]	195.41±34.3
DMI (gd^{-1})	0.0189	1480 [b]	1510 [a]	1600 [a]	1520±0.11
FCE	0.19	8.54 [a]	7.39 [b]	7.58 [b]	7.83±1.12
Me (MJd^{-1})	0.18	15540 [b]	15855 [a]	16800 [a]	16065±1.08

ILW = Initial Live weight, FLW = Final Live weight, LWG = Live weight gain, DMI = Dry matter intake, FCE = Feed conversion efficiency * Groups 1-2-3 are containing 19.86, 26.47 and 33.08g (DUP) respectively ** the means of standard error (a, b, c) in each line show significant difference between treatments ($p<0.05$).

Table V. Economic survey of experimental groups

Traits	Group 1	Group 2	Group 3
Feed intake cost / lamb (Rials)	120690 a	127672 a	158601 a
Unvariable profit/ lamb (Rials)	246750 a	286050 a	300000 a
Variable profit /lamb (Rials)	126061 b	158378 a	141399 a

* Groups 1-2-3 are containing 19.86, 26.47 and 33.08g DUP) respectively. ** The means of standard error. (a, b, c) in each line show significant difference between treatment ($p<0.05$).
(1$US=9100 Rial)

each Kg of produced meat was calculated 30000 Rials (1$US=9100 Rial). Variable profit was also calculated after deduction of feed intake cost from the un-variable profit of each male lamb (Table V).

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(Received 13 December 2005; Accepted 15 September 2006)