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Short Communication

Influence of Different Levels of Digestible Undegradable Protein on the Carcass Characteristic of *Kermani* Male Lambs in Iran

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ABSTRACT

Effect 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 growth of *Kermani* male lamb breed was studies. Six to seven month old 36 lambs with an initial live weight of 29 kg were taken and fed for 95 days. The level of metabolisable energy, 10.5 MJ kg^{-1} DM, was similar in all the rations. 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 three diets (n=12). The diets had no significant (P>0.05) effect on the weight of parts of carcass, edible and uncomestible internal substances and longissimus dorsi muscle. However, the digestible undegradable protein supplement had significant (P<0.05) effect on the chemical analysis of boneless meat (between 10-11-12 ribs), carcass weight, carcass efficiency and the length of the carcass. The results showed that the ration containing 26.47 g digestible undegradable protein (g kg^{-1} DM) was economically viable for growth of lambs.

Key Words: Digestible undegradable protein; Carcass characteristics; *Kermani* male lamb

INTRODUCTION

It is for a long time that crude protein is being fed 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 ruminants are not completely provided (McDonald *et al*., 1995). In order to improve protein uptake by animals, feed should be divided into its fractions 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; Shahrbabak *et al*., 2006; Sadeghi *et al*., 2009). Therefore, undegradable dietary protein (UDP) is necessary to provide amino acid requirements for potential growth of these kinds of animals. In this study, effect of different levels of digestible undegradable protein on the carcass characteristic of *Kermani* Male Lambs was investigated.

MATERIALS AND METHODS

Thirty six *Kermani* male lambs in Shahrbabak city were randomly selected 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 (group 1), 26.47 (group 2) and 33.08 (group 3) (g kg^{-1} DM), and one level of metabolisable energy (10.5 MJ kg^{-1} DM) based on the standard tables of male lambs feed of Agricultural and Food Research Council (AFRC) (AFRC, 1995) (Table II & III) were used. Experimental groups and their ingredients are shown in Table I. Diet materials (alfalfa & wheat straw) were mixed with the protein concentrate. The wool of lambs was sheared and vaccinated against current diseases (Enterotoxemia – Anthrax & 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 & 81 days for period of trial). The remained feed was collected and weighed in order to measure the daily feed intake. 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 completely randomized design with 3 diets (n=12) (SAS, 1986). The model is according to the following equation:

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

Where Y_{ij} is the records for jth replication and ith diets, μ: the total mean, t_i: the effect of ith diets, x_{ij}: the covariate

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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

Carcass efficiency. Carcass weight, carcass efficiency (carcass weight to weight before killing) in experimental groups 1, 2 and 3 are reported in Table IV. There is has significant (P<0.05) difference between weight and carcass percentage. The results show that about half of the lambs daily weight increase is related to the contents of the rumen weight, as well as edible and uncomestible internal substances. Group 3 has the most warm carcass weight (26.22 kg) and group 1 has the least warm carcass weight (21.52 kg). The comparison of the means of carcass percentage show that ration has significant (P<0.05) effect on carcass percentage. The highest carcass percentage is related to group 3 (53.07%) and the least of it is related to group1 (47.61%). Carcass efficiency is one of the criteria having differences and variety between breeds and different growth stages. Its improvement is of high value (Emam Jomeh, 1993). Obtained results in the recent study are in agreement with those obtained of Davarnia (1996) and Parsaei *et al*. (1994) while disagreement with Al Jassim *et al*. (1991) and Walz *et al*. (1998).

Parts of carcass. The mean of carcass parts (Neck, Tippet, Chest, Fillet, Femur, Fat tail) for different experiments groups are given in Table V. The results shows that ration has no significant (P<0.05) effect on weight and different percentage parts of carcass. However, increase DUP level in 2 and 3 groups causes slight increase in valuable carcass parts (fillet & femur). Therefore it can be concluded that DUP increase is not necessary to increase different carcass parts weight. Obtained results are in agreement with those obtained of Parsaei *et al*. (1994) and Foroozandeh (1996), while disagreement with Azarzamzam (1997) and Davarnia (1996). This can be due to the lowest level of DUP (19.86 g kg^{-1} DM) has provided the lambs needs.

Longissimus dorsi muscle and carcass length. Longissimus dorsi muscle (measured between ribs 12 & 13) and carcass length are criteria having an effect on muscular carcass. Carcasses with bigger longissimus dorsi muscle and the more length of carcasses have more fillet weight. Since the fillet is one of high value pieces of carcass, therefore these carcasses are more important (Noshary, 2001). The results shows that ration has significant (P<0.05) effect on length carcass and also has no significant (P<0.05) effect on longissimus dorsi muscle (Table VI).

Physical and chemical rib compound 10-11-12. Weight averages and physical rib parts 10-11-12 (the whole ribs, meat, fat & rib bones), meat and fat chemical analysis (without bone) of ribs 10-11-12, which are considered criteria of compound and proportions of carcass tissue are given in Table VII. As this table shows, there is no significant difference between weight and percentage physical parts of ribs 10-11-12 (P<0.05). Probably, all the lambs at the killing time have reached a fattened degree that physical rib parts (10-11-12) have reached their final growth. Overall, more fat percentage in typical lamb carcasses using group 3, has caused the decrease of meat and bone percentage in this experimental group compared with other groups. The obtained results related to typical fat

Table I. The percents of the ingredients of the feed rations (on dry matter)

Feed Ingredient rations	Groups* (1)	(2)	(3)
Alfalfa (%)	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

Table II. Chemical analysis of feed (%)

Ingredient feed	DM	CP	EE	ASH	ADF	NDF	ADIN (g kg^{-1} DM)	Ca	P
Alfalfa	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)

Table III. Energy and nutrient of feed

Nutrient and energy of ration	Groups 1	2	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 means of weight and carcass efficiency Kermani male lambs

Traits	SE**	Group* 1	2	3	Means ± standard error
Carcass weight (kg)	0.35	21.52 [b]	25.60[a]	26.22 [a]	24.446±1.25
Carcass efficiency (%)	0.96	47.61 [b]	53.01 [a]	53.07 [a]	51.226±3.02

*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. the means of weight and different percentage parts of carcass Kermani male lambs

Traits	SE**	Ration*			Means ± standard error
		1	2	3	
Carcass weight parts (kg)					
Neck	0.057	1.55	1.77	1.76	1.69±0.244
Tippet	0.096	3.92	4.05	4.02	3.99±0.409
Chest	0.106	4.56	4.57	4.93	4.68±0.452
Fillet	0.079	3.30	3.40	3.49	3.40±0.338
Femur	0.106	6.25	6.30	6.33	6.29±0.452
Fat tail	0.244	3.39	4.14	4.47	3.99±1.036
Carcass percent parts (%)					
Neck	0.204	6.69	7.35	7.04	7.02±0.869
Tippet	0.264	17.12	16.81	16.07	16.67±1.121
Chest	0.272	19.67	18.95	19.74	19.45±1.157
Fillet	0.269	14.27	14.13	13.98	14.13±1.144
Femur	0.372	27.05	26.20	25.32	26.20±1.579
Fat tail	0.837	14.74	16.90	17.82	16.48±3.553

*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 VI. The means of Longissimus dorsi muscle and carcass length Kermani male lambs

Traits	*SE***	*Group**			*Means ± standard error*
		1	2	3	
Longissimus dorsi muscle (m^2)	0.882	14.16 [a]	14.83 [a]	17.5 [a]	15.5±3.745
Carcass length (cm)	0.632	67.66 [b]	70.33 [ab]	71.5 [a]	69.83±2.68

*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 VII. The means of weight and physical and chemical percentage compounds of ribs 10-11-12 Kermani male lambs

Traits	SE**	Group*			Means ± standard error
		1	2	3	
Physical analysis of ribs 10-11-12*					
Ribs weight	0.013	0.46	0.49	0.51	0.554±0.055
Weight of rib bones	0.005	0.08	0.08	0.06	0.074±0.021
Weight of rib meat	0.007	0.22	0.23	0.23	0.266±0.029
Weight of rib fat	0.008	0.18	0.19	0.20	0.192±0.033
Bone percentage	1.308	17.4	16.72	12.25	15.53±5.549
Meat percentage	0.987	47.82	45.31	45.26	39.48±4.187
Fat percentage	1.478	38.99	39.43	40.03	39.48±6.270
Fat and meat percentage	1.308	82.99	83.28	87.75	84.674±5.54
Chemical analysis of ribs 10-11-12**					
Raw protein percentage	0.293	12.29 [a]	12.03 [a]	10.51 [a]	11.61±1.243
Raw fat percentage	0.747	38.56 [b]	41.16 [a b]	42.45 [a]	40.72±3.169
Moisture percentage	0.667	45.05 [a]	45 [a]	41.89 [a]	43.78±2.829
Ash percentage	0.015	0.681 [a]	0.710 [a]	0.611 [b]	0.667±0.063

*Groups 1-2-3 are containing 19.86, 26.47 and 33.08g (DUP) respectively.
The means of standard error. * All the weights are per Kg and percentage is per the total weight of ribs 10-11-12
****Chemical analysis related to deboned meat and fat. (a, b, c) in each line show significant difference between treatments (p<0.05).

Table VIII. The means of weight (kg) and edible and un-comestible internal substances percentage compared with live weight before slaughter

Traits	SE **	Group*			Means ± standard error
		1	2	3	
Live Weight before slaughter	0.598	45.2 [b]	48.3 [a]	49.4 [a]	47.61±3.5
Head weight	0.062	2.73	3.02	2.87	2.877±0.26
Head percentage	0.125	6.06	6.27	5.85	6.051±0.532
Trotters weight	0.015	0.80	0.82	0.86	0.825±0.063
Trotters percentage	0.032	1.77	1.70	1.73	1.732±0.136
Skin weight	0.158	4.14 [b]	4.71 [a b]	5.25 [a]	4.701±0.67
Skin percentage	0.215	9.16 [b]	9.76 [a b]	10.44 [a]	9.224±0.457
Blood weight	0.068	1.31	1.35	1.26	1.308±0.288
Blood percentage	0.123	2.86	2.80	2.55	2.735±0.523
Full stomach weight	0.162	4.76	5.61	5.13	5.167±0.689
Full stomach weight	0.268	10.5	11.62	10.38	10.836±1.140
Empty stomach weight	0.037	1.35	1.40	1.51	1.42±0.160
Empty stomach percentage	0.057	2.99	2.89	3.04	2.977±0.243
Heart weight	0.003	0.16	0.15	0.165	0.16±0.015
Heart percentage	0.009	0.36	0.32	0.33	0.335±0.039
Lungs weight	0.014	0.47	0.49	0.44	0.465±0.063
Lungs percentage	0.034	1.04	1.01	0.89	0.975±0.145
Liver Weight	0.023	0.67	0.74	0.76	0.72±0.101
Liver percentage	0.030	1.46	1.52	1.53	1.502±0.129
Spleen weight	0.002	0.06	0.06	0.06	0.062±0.011
Spleen percentage	0.112	0.14	0.12	0.13	0.288±0.477
Kidneys weight	0.003	0.10	0.10	0.11	0.103±0.013
Kidneys percentage	0.004	0.27	0.20	0.21	0.212±0.018
Testis weight	0.020	0.34	0.37	0.38	0.366±0.087
Testis percentage	0.040	0.75	0.77	0.77	0.762±0.170
Visceral fat weight	0.122	1.97	2.36	2.35	2.225±0.521
Visceral fat percentage	0.322	4.31	4.86	5.49	4.882±1.369
Visceral fat weight + fat tail	0.302	5.36	6.50	6.79	6.213±1.786
Visceral fat percentage +fat tail	0.582	11.90	13.45	13.74	13.03±1.443

*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)

percentage in different experiments with all visceral fat and fat tail percentage of the whole-fed lamb carcasses, had coordination (Table VII). In both cases, fed lambs with group 3, had more fat percentage in carcass with the studied type (Table VII). In a recent study it has been reported that increased percentage of carcass fat is accompanied with the decrease of pure meat and bone percentage (Kianzad, 1993). In another research it has been specified that with the increase of the living animal weight, protein proportion has been decreased relatively in the amount of daily weight and fat amount has increased (Church, 1988). The results shows that feed ration has significant influence on chemical rib compound (10-11-12) (P<0.05). As DUP feeding level of group 3 has increased carcass fat percentage (P<0.05) and decreased moisture percentage of carcass. In this study DUP level had no significant influence on protein and dehoned meat moisture (P<0.05). Obtained results are in agreement with those obtained of Church (1988), While disagreement with Sinclair *et al.* (1991) and Jafari Khorshidi (1996). Results obtained show that there is a negative coordination between raw protein percentage and raw fat of carcass.

Edible and un-comestible internal substances. The obtained results of edible and uncomestible internal substances and their percentage compared with animal weight before slaughter is given in Table VIII. The results show that the only significant difference in weight and skin percentage (p<0.05) is the quantity of the experiments

Table IX. Economic survey of experimental rations (Rials)

Traits	Group*		
	1	**2**	**3**
Feed intake cost per lamb (Rials)	120690 [a]	127672 [a]	158601 [a]
Unvariable profit per lamb (Rials)	246750 [a]	286050 [a]	300000 [a]
Variable profit per 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)

groups. The significant reason of weight and skin percentage can be related to the increase of wool weight and skin in the group 3 had the least amount.

Economic value. 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 1 kg of live weight gain has been calculated separately for different groups (The calculated expenses have just been those of feed & those of personal, capital amortization & installation have not been calculated). According to these calculations, feed intake cost for the production of one kg of live weight gain for groups 1, 2 and 3 were 7335, 6695 and 7930 Rials, respectively. The sale amount of 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 IX).

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