

ENERGY AND PROTEIN REQUIREMENTS FOR GROWTH OF BALADI GOATS

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SUMMARY

In a 12 week experiment, ten growing six months old Baladi goat kids (five males and five females) of an average initial body weight of 8.93 Kg were fed a ration of 63.26% TDN and 8.05% DCP. Initial and final body composition was estimated using the Antipyrine space method to calculate the energy and protein requirements for growth

Energy and protein requirements for growth of indigenous goats (Baladi) were found to be 11.29 kcal ME and 0.6 g DCP per gram body weight gain for males and 13.47 kcal ME and 0.72 g DCP for females with average values of 12.38 kcal ME and 0.66 g DCP/g daily gain. These values were higher than 7.25 kcal ME and 0.195 g DCP per gram body weight gain as suggested by the NRC (1981).

Keywords: Goats, growth, requirements, energy, protein

INTRODUCTION

Studies on energy and protein requirements for growth of indigenous Egyptian growing goats are rare. However, the need to establish Egyptian feeding standards for requirements of farm animals increases. In most cases the NRC standards were considered to calculate such requirements. El-Bedawy *et al.* (1994) estimated the DCP maintenance requirement of Baladi goats as $1.95 \text{ g/KgW}^{0.75}$ which was less than $2.82 \text{ g/Kg W}^{0.75}$ reported by the NRC (1981). In another study, El-Bedawy *et al.* (1993) found that energy and protein requirements for growth of Zaraibi goats were 242 g TDN and 68 g DCP per 100g daily body weight gain which were higher than 200 g TDN and 20 g DCP (NRC 1981). The objective of the present study is to provide an estimation of energy and protein requirements for growth of Baladi growing male and female goat kids and to compare these figures with those of NRC (1981) for growing goats.

MATERIALS AND METHODS

In a 12 week experiment, ten growing six months old Baladi goat kids of an average initial body weight of 8.93 Kg were individually fed a ration consisted of concentrate mixture (CM) and chopped berseem (*Trifolium alexandrinum*) hay. Concentrate mixture was fed at the rate of 2.5% of body weight while chopped berseem hay was fed *ad libitum*. Feeds were offered once daily at 8.00 a.m. and feed residues were daily collected, sun dried and weekly weighed. Animals were weekly weighed and the daily gain was recorded. Clean drinking water was free choice available. The concentrate mixture was composed of 25% undecorticated cotton seed meal, 25% yellow corn, 30% wheat bran, 15% rice bran, 2% molasses, 2% lime stone and 1% common salt. Chemical composition of feeds is presented in Table 1.

Nine digestibility trials were carried out to determine nutrient digestibilities and nutritive value of the experimental ration at the beginning, mid and end of the experimental period each using three different animals selected at random. Nutrient digestibilities were averaged in Table 2.

Initial and final *in vivo* body composition of all animals was determined applying the antipyrine space method. Two ml (0.4 mg/ml) antipyrine solution were intravenously infused before feeding or watering. Blood samples were withdrawn from the jugular vein after 30 min. and concentrations of antipyrine were colorimetrically measured. The antipyrine space was determined using the extrapolation method (Panaretto and Till, 1963). Data of body composition was used to calculate the gain in water, fat, protein and ash. Chemical composition of feeds, feces and urine was determined according to the A.O.A.C. (1984) methods. The difference between males and females was tested by t-test (Steel and Torrie, 1980)

RESULTS AND DISCUSSION

Data in Table 1 show the chemical composition of concentrate mixture and berseem hay. The chemical composition of the experimental ration was proportionally calculated from the chemical composition feeds consumed by each animal.

Table 1. Chemical composition of experimental feeds.

Composition	Concentrate mix.	Berseem hay
Dry matter (DM), %	89.10	90.70
DM composition, %		
Crude protein	14.50	12.30
Ether extract	4.90	0.85
Crude fiber	17.62	36.16
N-free extract	53.23	38.59
Ash	9.75	12.10

No significant differences were detected in nutrient digestibilities between males and females. Therefore, data were averaged in Table 2 for both sexes. Means of nutritive value were 63.26% TDN and 8.05% DCP. Dry matter intakes (DMI) from concentrate mixture and berseem hay are shown in Table 3.

Table 2. Nutrient digestibilities and nutritive value of the experimental ration

Item	Mean	±SD
Digestibility, %		
DM	64.70	2.88
OM	70.52	2.67
CP	59.36	3.21
EE	88.52	4.29
CF	49.55	7.90
NFE	77.10	2.25
Nutritive value, %		
TDN	63.26	2.46
DCP	8.05	0.42

Table 3. Body weight (BW), feed intake by male (M) and female (F) Baladi kids.

Anim. No	Sex	BW, Kg	CM g /day	Hay g /day	Total DM g/day	Hay% of DM	DMI %of BW	TDN g/day
6322	M	11.30	252.6	252.6	505.2	49.94	4.47	319.2
6327	M	10.15	227.8	253.8	481.6	52.70	4.74	304.6
6328	M	10.35	230.5	237.0	467.5	50.70	4.52	295.7
6335	M	9.73	218.0	248.1	466.1	53.23	4.79	294.8
6337	M	9.84	220.3	245.0	465.3	52.66	4.73	294.3
Av.		10.27	229.8	247.2	477.1	51.85	4.65	301.8
±SD		0.62	13.7	6.6	17.1	1.44	0.14	10.6
6339	F	11.45	256.2	214.1	470.3	45.52	4.11	297.5
6336	F	9.46	211.3	228.7	440.0	51.99	4.65	278.3
6323	F	7.61	171.2	251.0	422.2	59.46	5.55	267.1
6329	F	14.75	329.7	254.5	584.2	43.57	3.96	369.5
6334	F	8.46	188.2	242.3	430.5	56.28	5.09	272.4
Av.		10.35	231.3	238.1	496.4	51.36	4.67	296.9
±SD		2.85	63.6	16.7	66.7	6.80	0.66	42.2
Prob.		0.48	0.48	0.15	0.40	0.44	0.47	0.46
Mean		10.31	230.6	242.7	473.3	51.6	4.66	299.4
±SD		1.94	43.4	12.9	46.1	4.64	0.45	29.1

No significant difference in DMI was found between males and females. The TDN intake was calculated by multiplying the DMI by the diet TDN% (Table 2).

Daily gain of body water, fat, protein and ash are presented in Table 4. The values were calculated as the difference between final and initial *in vivo* body composition applying the antipyrine space method developed by Panaretto and Till (1963) using

goats. Males gained more water, protein and minerals than females, however, these differences were not significant because of the high individuality in local goats. Standard deviation (SD) values were about 23% of the mean values of water and protein and 28% for fat and ash. The high SD values might be due to that dilution techniques including the antipyrine space method are not sufficiently proven accurate to estimate body composition. However, it was applied to male and females in the present experiment as an economic technique to avoid sacrificing live animals (Owen, 1981).

Table 4. Composition and energy content of body weight gain of male (M) and female (F) Baladi kids.

Anim No	Sex	Gain Kg	Gain composition, Kg				Gain Mcal	NE _g kcal/g gain
			Water	Fat	Protein	Ash		
6322	M	3.80	2.24	0.75	0.56	0.25	10.32	2.72
6327	M	4.50	2.67	0.89	0.73	0.21	12.62	2.80
6328	M	3.50	1.86	0.90	0.54	0.20	11.63	3.32
6335	M	3.30	1.84	0.80	0.44	0.22	10.11	3.06
6337	M	3.80	2.30	0.67	0.63	0.20	9.96	2.62
Av.		3.78	2.18	0.80	0.58	0.22	10.93	2.90
±SD		0.46	0.35	0.64	0.11	0.02	1.15	0.28
6339	F	3.00	1.63	0.78	0.45	0.14	9.98	3.33
6336	F	4.20	2.45	0.87	0.67	0.21	12.08	2.88
6323	F	2.80	1.60	0.63	0.44	0.13	8.49	3.03
6329	F	3.30	1.38	1.42	0.40	0.10	15.77	4.78
6334	F	2.40	1.32	0.60	0.36	0.12	7.75	3.23
Av.		3.14	1.68	0.86	0.46	0.14	10.81	3.45
±SD		0.68	0.45	0.33	0.12	0.04	3.23	0.76
Prob.		0.06	0.04	0.36	0.07	0.003	0.47	0.08
Mean		3.46	1.93	0.83	0.52	0.18	10.87	3.18
±SD		0.64	0.46	0.23	0.12	0.05	2.29	0.61

Energy Kcal/g gain = (fat x 9.5 + protein x 5.70)/body gain (Kleiber, 1961)

Metabolizable energy (ME) intake in Table 5 was calculated as TDN intake x 3.5969 (NRC, 1981). The ME requirement for growth (Mcal/head/day) was calculated as difference between total daily ME intake and ME required for maintenance (101.38 kcal/KgW^{0.75} NRC, 1981). The NRC (1981) standard was calculated as an average of 10 values ranged from 87.31 to 115.09 kcal ME/ Kg W^{0.75}. Lu and Potchoiba (1990) applied the same procedure to estimate energy and protein requirements for growth of goat kids. The ME_g was 503.6 kcal for males and 486.6 kcal for females. The corresponding values ME/gain (kcal/g) were 11.29 for males and 13.47 for females with no significant difference between both sexes. These values were much higher than that recommended by NRC (1981) as 7.25 kcal ME/g gain, probably

because of local goats are of low genetic potentiality in growth and are not bred for any specific purpose. The present values are close to 10.18 kcal ME/g gain which was suggested by Devendra (1967) for growing indigenous Malaysian goats.

Table 5. Efficiency of energy utilization for growth by male (M) and female (F) Baladi kids.

Anim. No	Sex	BW Kg ^{0.75}	Intake ME kcal/day	ME _m kcal/d ay	ME _g kcal/d ay	ADG g/day	ME _g kcal/g gain	NE _g kcal/g gain	K value
6322	M	6.16	1148	625	524	45.24	11.57	2.72	0.24
6327	M	5.69	1096	577	519	53.57	9.69	2.80	0.29
6328	M	5.77	1064	585	479	41.67	11.49	3.32	0.29
6335	M	5.51	1061	559	5021	39.29	12.77	3.06	0.24
6337	M	5.56	1059	564	495	45.24	10.94	2.62	0.24
Av.		5.74	1085	582	506	45.00	11.29	2.90	0.26
±SD		0.26	38	26	18	5.41	1.12	0.28	0.03
6339	F	6.22	1070	631	439	35.71	12.30	3.33	0.27
6336	F	5.39	1001	546	455	50.00	9.09	2.88	0.32
6323	F	4.58	961	464	496	33.33	14.89	3.03	0.20
6329	F	7.53	1329	763	566	39.29	14.40	4.78	0.33
6334	F	4.96	980	503	477	28.57	16.69	3.23	0.19
Av.		5.74	1068	582	487	37.38	13.47	3.45	0.26
±SD		1.17	152	119	49.28	8.06	2.91	0.76	0.07
Prob.		0.50	0.41	0.50	0.24	0.12	0.08	0.17	0.48
Mean		5.74	1077	582	495	41.19	12.38	3.18	0.26
±SD		0.80	105	81	36	7.62	2.37	0.61	0.05

$$\text{Intake ME kcal/day} = \text{TDN} \times 3.5969 \text{ (NRC, 1981)}$$

$$\text{ME}_m \text{ kcal/day} = \text{Wt, Kg}^{0.75} \times 101.38 \text{ (NRC, 1981)}$$

Efficiency of ME utilization for growth (k value) which was calculate as the proportion of NE (Table 4) from the ME of growth was 26% for both males and females

The DCP requirement for growth (Table 6) was calculated as the difference between DCP intake and that required for maintenance recently suggested as 1.95 g/Kg W^{0.75} by El-Bedawy *et al.* (1994). The DCP requirement for growth was found to be 0.60 g/g body weight gain for males and 0.72 g for females with an average of 0.66 g DCP/g gain. The higher protein requirement for growth of females might be due to that they grown slower than males at the same age (Table 4). The NRC (1981) DCP requirement have been based on an average value of 0.195 g DCP/ g body weight gain. El-Bedawy *et al.* (1993) suggested comparable figure (68 g DCP/100 g gain) as protein requirement for local goats of an average daily gain of 60 g/day. The higher protein requirements for growth of local goats than that of NRC (1981) might be due to that the low growth efficiency of local Egyptian goats.

Table 6. Efficiency of digestible crude protein utilization for growth by male (M) and female (F) Baladi kids.

Anim. No	Sex	Wt.Kg ^{0.75}	DCP intake g/day	DCP _m g/day	DCP _g g/day	DCP/gain (g/g)
6322	M	6.16	40.14	12.02	28.12	0.622
6327	M	5.69	38.13	11.09	27.04	0.505
6328	M	5.77	37.14	11.25	25.89	0.621
6335	M	5.51	36.88	10.74	26.14	0.665
6337	M	5.56	36.85	10.83	26.02	0.575
Av.		5.74	37.83	11.19	26.64	0.60
±SD		0.26	1.39	0.51	0.94	0.06
6339	F	6.22	37.68	12.14	25.54	0.715
6336	F	5.39	34.88	10.52	24.36	0.487
6323	F	4.58	33.06	8.63	24.13	0.724
6329	F	7.53	46.96	14.68	32.28	0.822
6334	F	4.96	33.89	9.67	24.22	0.848
Av.		5.74	37.29	11.13	26.11	0.72
±SD		1.17	5.68	2.37	3.50	0.14
Prob.		0.50	0.42	0.48	0.37	0.06
Mean		5.74	37.56	11.16	26.37	0.66
±SD		0.80	3.91	1.61	2.43	0.12

$$DCP_m \text{ (g/day)} = 1.95 \times KgW^{0.75} \quad (\text{El-Bedawy et al., 1994})$$

It could be concluded that the energy and protein requirements of the indigenous (Baladi) growing goats might be calculated as 11.29 kcal ME and 0.6 g DCP per gram body weight gain for males and 13.47 kcal ME and 0.72 g DCP for females with average values of 12.38 kcal ME and 0.66 g DCP/g daily gain.

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احتياجات النمو من الطاقة و البروتين للماعز البلدى

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فى تجربة لمدة ١٢ أسبوع، استخدمت عشرة جداء خمسة ذكور وخمس إناث عمرها ٦ شهور و متوسط وزنها ٨,٩٣ كجم. غنيت على علفه تحتوى على ٦٣,٢٦% مركبات مهضومة كلية و ٨,٠٥% بروتين خام مهضوم مقدره كمتوسط لتسعه تجارب تمثيل غذائى. كما قدر تركيب الجسم فى بداية ونهاية التجربة باستخدام طريقة حيز الأنتيبيرين لحساب الاحتياجات من الطاقة والبروتين للنمو.

وقد قدرت الاحتياجات من الطاقة لتكون ١١,٢٩ كيلو كالورى طاقة ممثلة و ٠,٦٠ جم بروتين خام مهضوم لكل اجم زيادة فى الوزن الحى للذكور و ١٣,٤٧ كيلو كالورى طاقة ممثلة و ٠,٧٢ جم بروتين خام مهضوم للإناث بمتوسط ١٢,٣٨ كيلو كالورى طاقة ممثلة و ٠,٦٦ جم بروتين خام مهضوم لكلا الجنسين.