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Protein requirements of growing Shami kids using protected methionine

Mutassim M. Abdelrahman
King Saud University, College of Food and Agricultural Sciences, Department of Animal production, P.O. Box 2460, Riyadh 11451, Saudi Arabia

Corresponding author E mail: amutassim@ksu.edu.sa Mobile: 00966566194484Fax: 0096614678474
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1 SUMMARY

A study was conducted to evaluate the effect of feeding different levels of protein to growing kids of the Shami breed. Weanling Shami kids (n=18; 75 to 90 days old) were selected and individually housed at the experimental farm. Kids were divided randomly to one of the three treatments. The three dietary treatments were: T1: Control ration, formulated according to NRC (1981) to cover the protein and other nutrients required (level 1.)., 2: T2, ration formulated to covered only 75% of protein recommended by NRC (level 2.) and 3: T3, Control diet + protected methionine 2.4 g Smartamine® / day/ kid (level 3). Kids were individually fed their respective diets ad libitum for 12 weeks and feed intake was recorded daily for each kid. Initial and monthly body weights were also recorded. Blood samples were collected monthly and analyzed for the metabolite levels of Co, Zn and Cu. Data were analyzed using CRD with repeated measurements. Decreasing the dietary level of protein (T1) negatively affected (P<0.05) the total live weight gain, average daily gain and feed conversion ration when compared with the control and T2 groups. There was no significant effect (P>0.05) of treatments on the total feed intake. Moreover, methionine supplementation, time and time x treatment caused a significant (P<0.05) change on Co concentration in blood serum with a higher value at the end of the experiment. Only time effect (P<0.05) was detected on cholesterol, albumin and creatinine levels with lower values at the end of the experiment. Methionine supplementation (T2) increased the growth rate and density of Shami hair when compared with the control and T1 groups. In conclusion, the NRC recommendation level of protein for growing kids cover the requirements of growing Shami breed kids with proper performance. Feeding protected methionine (Smartamine®) above NRC requirements only affects the growth and yield of Shami kids' hair.

2 INTRODUCTION

Shami goat is widely distributed in the Mediterranean region (Titi *et al.*, 2008) as a major breed for milk and meat production. Feeding Shami goats in the Mediterranean countries depends on the natural range, crop residues (for a very short period of the year), limited barley and wheat bran supplementation (FAO, 1994). A shortage in protein and other nutrient are expected under this extensive system which may affect their general health and performance. Therefore, there is an urgent need to cover nutrients requirements to increase goats' productivity, through intensive farming. Unfortunately, there is a limiting data regarding the protein and other nutrients requirements of Shami kids and other breeds in the Mediterranean region. National Research Council (1981) identifies the nutrient requirements of the international temperate breeds which may not be applicable to Arabian breeds, because of differences in growth potential and the environmental factors (Aregheore *et al.*, 2003). Silva (2001) reported a higher net protein requirements for growing lambs from breed (Santa Ines lambs) to another (Ile de France lambs), and protein requirements levels were

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20% higher than those recommended by ARC (1980). Supplementation of rumen protected methionine increases the proportion of dietary amino acids that is absorbed from the intestine (Archibeque *et al.*, 2002). They reported that the absorbed methionine meets a critical limitation and improves the overall use of nitrogen in the diet. There is more potential to produce profit, while minimizing undesirable environmental impacts through modification of protein metabolism. Ali *et al.*, (2009) reported that supplementation of ruminally protected proteins and amino acids improved feed consumption, digestion and performance of ruminant animals. Virk *et al.*, (1994) demonstrated that feeding protected protein caused a significant increase in growth rate and nitrogen retention in goats. On the other hand, regarding the effect of energy level on performance, Abdelrahman (2010) reported that NRC (1981) recommendation for energy for growing kids is adequate for proper growth and performance. Moreover, undegradable methionine (sulfur amino acid), as the main limiting amino acid, may affect the bioavailability of other minerals. So, studying the negative or positive effects is necessary by measuring the accumulation of minerals in blood serum and tissues as a reliable indication (Underwood and Suttle, 2001). Hence, a need for accurate level of protein requirements and effect on performance of different goat breeds is very crucial. The main objective of this study is to determine the effect of different levels of protein, using protected methionine, on the performance of growing Shami kids raised under semi arid conditions.

3 MATERIAL AND METHODS

3.1 Animal feeding, sampling and management: Weanling Shami kids (n=18 for each), about 75 to 90 days old, were selected and individually housed at Mutah University Research Station. Kids were injected sub-cutaneously with 2 mls enterotoxaemia vaccine and divided randomly to one of the three treatments. The three dietary treatments were: T1: Control ration, formulated according to NRC (1981) to cover the protein (level 1.) and other nutrients required. 2: T2, ration formulated to covered only 75% of protein recommended by NRC (level 2.). 3: T3. Control diet + protected methionine 2.4 g/ day of *Smartamine*® (level 3). Kids were individually fed ad libitum their respective diet (Table 1.) for 12 weeks and feed intake was recorded daily for each kid.

Table 1: Feed composition as a fed used in this experiment contain two level of crude protein

Ingredients (%)	**Control (NRC, 1981 protein recommended)**	**Treatment (75% of protein recommended by NRC, 1981)**
Corn	15.0	15.0
Barley	55.4	61.4
SBM	6.0	0.0
Tibin	10	10
Wheat bran	12.0	12.0
Salt	0.5	0.5
CaCO3	1.0	1.0
Min. &Vit.	0.1	0.1
Total	100.0	100.0
Chemical composition (As fed):		
Dry matter%	89.23	89.11
Crude protein (g/ kg)	129.95	101.45
Metabolizable energy (Mcal/ kg)	2.53	2.53
Calcium (g/ kg)	4.79	4.64
Phosphorus (g/ kg)	4.45	4.28

1 Minivit-Forte, VAPCo, each 1 kg contains: Cu sulphate= 9.417 mg, Fe sulphate= 85 mg, Mg sulphate= 535 mg, Mn sulphate= 41.25 mg, Zn sulphate= 77.2 mg, Di-Ca phosphate = 145 mg. Vit A= 6250 I.U, vit D3= 1510 I, U, vit E= 4.375 I.U., Cobalt chloride= 1.933 mg, K iodide= 6.367 mg and Na selenite= 0.274 mg.

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Clean water was available throughout the day. Initial and monthly body weights were also recorded. Blood samples from the jugular vein were collected monthly using non heparin vacutainer tubes and serum separated by centrifugation at 3000 rpm/ 15 minutes. Four kids from each group were slaughtered and hot carcass and omental fat weights were recorded. The biological samples were analyzed for the following: 1) Blood serum samples were analyzed for mineral concentrations using Atomic Absorption Spectrophotometer (AAS); 2) Blood glucose, triglyceride, total protein, cholesterol and creatinine were measured by using available commercial kits. To determine the effect of protected methionine on the density, length and diameter of growing hair during the experimental period, shaved 25 cm^2 from different body areas, from all the experimental kids, to weight the higher densities by averaging the values for all areas. Fiber samples were taken representing different body locations for measuring the hair diameters by using microscope and micrometer. Moreover, the lengths of the hair were measured by using a regular ruler.

3.2 Statistical analysis: Data were analyzed using the General Linear Model (GLM) of Statistical analysis system (SAS, 2002) as a complete randomized design (CRD) with repeated measurements. Protected LSD test was used to compare between means for significance.

4. RESULTS AND DISSCUSION

Sufficient supply of protein and well balance amino acids especially the most limited amino acid, methionine and lysine, is a very crucial factor for proper growth by ruminants. The effect of protein levels on the performance of Shami kids is shown in table 2.

Table 2: The effect of feeding the different protein levels on the general performance of the growing Shami kids

Treatment	*Initial BW* X`	SD	*Final BW* X`	SD	AccGain[3] X`	SD	AccADG[4] X`	SD	AccFCR[5] X`	SD	TFI[6] X`	SD
Control	23.3	12.	37.6	2.3	14.4a	1.2	0.169a	0.013	5.7a	0.42	82.08	9.4
T1[1]	24.8	2.4	37.7	2.6	12.8b	1.1	0.148b	0.014	6.4b	0.49	82.70	8.1
T2	21.0	1.7	35.4	1.9	14.2a	0.9	0.166a	0.010	5.9a	0.35	82.40	6.6
Sign.	NS		NS		*		*		*		NS	

[1] 75% of protein daily requirements
[2] Dietary protein according to NRC+ 2.4 g protected methionine.
[3] Accumulated gain
[4] Accumulated average daily gain
[5] Accumulated feed conversion ratio., [6] Total feed intake, NS= Not significant, * P<0.05

Reducing the dietary protein level below the NRC recommendation (T1) caused a significant decrease in accumulated live weight gain ($p<0.05$), accumulated average daily gain ($p<0.05$) and increase the accumulated feed conversion ratio ($p<0.05$). There was no significant effect ($P>0.05$) of the treatments on the total feed intake, dressing percentages, as the hot carcass weight was (48.9 vs 47.81 and 49.3%, respectively) and omental fat percentages were (4.01 vs 3.80 and 4.23%, respectively). Furthermore, feeding growing Shami kids undegradable methionine (T2), above the NRC (1981) recommended level didn't cause any improvements in accumulated weight gain, average daily gain and FCR when compared with the control. Regarding the effect of protein level on performance, Abdelrahman (2010) reported that feeding undegradable methionine (*Smartamine*® ®) didn't cause any significant improvement on their performance in term of growth and feed conversion. He concluded that NRC (1981) recommendation for energy and protein for growing kids are adequate for proper growth and performance. Wiese *et al.* (2003) found that increasing the dietary level of methionine by using *Smartamine*® to Merino lambs did not lead to any

increase in growth rate, daily feed intake, feed conversion or final body weight which completely agreed with this study findings. In addition, Atti *et al.* (2004**)** and Soto-Navarro *et al.* (2004) reported that the optimum crude protein level in growing goats' concentrate for maximum performance is approximately 130 g/ kg BW and any increase above this level did not improve performance. This level of feeding protected methionine to goats cause very little effect on the studied traits and their effect was reduced significantly with high dietary crude protein feeding which consistent with the present findings. In a different study conducted by Shahjalal *et al.* (2000), studying effect of diets with 16.9 and 20.35 CP%, in black Bengal goats, indicated a higher live body weight gain with increasing dietary protein (20.3%) which disagreed with our findings. This disagreement may be resulted from breed, feed type, stage of growth and environmental factors (Negesse *et al.*, 2001). For lambs, Zundt *et al.* (2002) reported a linear effect of protein level (12, 16, 20 and 24%) on average daily gain which differs from our results. But Nuno *et al.* (2009) found that the protein levels in the diet (14, 16 and 18%) had little or no effect on the performance of Dorper or Pelibuey lambs during fattening which agreed with ours. This disagreement with sheep may be mainly resulted from a species differences in term of protein requirements. According to this study findings, it is clear that feeding growing Shami kids 14% crude protein as recommended by National Research council (NRC, 1981) is quite adequate to cover their requirements of protein and no effect of adding the undegradable methionine above 14% on their growth performance. For the feed intake, the result was consistent with Chobtang *et al.* (2009) and Prieto *et al.* (2000) who found that there was no significant effect of different levels of protein in diet on the feed intake of Thai indigenous male goats, Spanish and Boer-Spanish crossbred kids. Moreover, Zundit *et al.* (2002) did not detect any significant effect of increasing dietary crude protein on dry matter intake by growing lambs which agreed with ours. In contrast, there was evidence that dry feed intake in Alpine and Nubian goats linearly increased as a result of increasing dietary CP levels (Lu and Potchoiba, 1990). Negesse *et al.* (2001) also confirmed the same trend in increasing feed intake with increasing dietary protein. It is possible that the difference in animal breed, feed ingredients composition and environmental factors are the reason for variation. On the other hand, the feed conversion ratios (FCR) showed a significantly drop down in kids from T1 group (low protein) when compared with the control (NRC, 1981) and T2 (Undegradable protein; high protein) with no differences between the control and T2. Obtained result is in agreement with the findings of Hussein and Jordan (1991); Beauchemin *et al.* (1995) and Haddad *et al.* (2001) and disagreed with Shahrbabak *et al.*, (2006).

Moreover, methionine supplementation, time and time x treatment caused a significant ($P<0.05$) change on Co concentration in blood serum with higher value at the end of the experiment (Table 3.). Moreover, only time showed a significant effect ($P<0.05$) on the Co, Cu and Zn concentrations with higher value at the end of the experiment (Table 3.). Unfortunately, very little work has been carried out to study the negative or positive effect of feeding undegradable methionine (sulfur amino acid) on trace minerals bioavailability in ruminants. The results of this experiment showed significant change in term of increasing and decreasing trace minerals concentrations in different tissues, but all values were within the normal levels according to Puls (1990).

Table 3: The effect of feeding the different protein levels, time and time by treatment interaction on the cobalt, copper and zinc concentration in the blood serum of the growing Shami kids

	Time				SE[3]	Trt[1]	Time[2]	Trt x Time
	1	2	3	4				
Co	0.34	0.366	0.39	0.500	0.03	*	***	*
Cu	0.43	0.224	0.37	0.403	0.08	NS	*	NS
Zn	0.33	0.804	1.52	1.82	0.19	NS	*	NS

[1] treatment, [2] time of taking blood samples (Monthly) , [3] Standard error of means., NS Not significant, * $P<0.05$, ** $P<0.01$, *** $P<0.001$

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Only time effect (P<0.05) was detected on cholesterol, albumin and creatinine levels with lower values at the end of the experiment (Table 4.). Abdel-Ghani *et al.* (2011), Shahen *et al.* (2004) and Yousef and Zaki (2001) reported a positive correlation between dietary protein and serum total protein concentration in goats. This finding was in agreement with those reported by El-Shabrawy (2006). On the other hand, the findings reported by El-Reweny (2006) were inconsistent with ours. On the other hand, Abdel-Ghani *et al.* (2011) reported a significant reduction in creatinine in blood serum of lamb as a result of feeding protected protein which disagreed with our findings. They explained their finding assuming a higher utilization of dietary protein occurred as a result of protection.

Table 4: The effect of feeding the different protein levels, time and time by treatment interaction on blood serum metabolites of the growing Shami kids

	Time							
Measurements	**1**	**2**	**3**	**4**	**SEM[3]**	**Trt[1]**	**Time[2]**	**Trt x Time**
Cholesterol[4]	70.1	68.2	74.0	59.9	4.6	NS	**	NS
Albumin[5]	3.13	2.57	3.17	2.61	0.26	NS	**	NS
Protein[5]	6.37	6.14	6.26	6.10	0.43	NS	NS	NS
Ceratinine[4]	1.76	1.39	1.50	1.25	0.18	NS	*	NS
Glucose[4]	58.0	61.33	65.27	59.67	5.1	NS	NS	NS

[1] treatment
[2] time of taking blood samples (Monthly)
[3] Standard error of means.
NS Not significant
* P<0.05, ** P<0.01, 4 mg/dl, 5 g/dl

By- pass methionine supplementation (T2) increased the growth rate and density of Shami hair when compared with the control and T1 groups (Table 5.). Few studies were reported in the literature studying the effect of dietary protein levels on the hair growth of Shami kids. But in general, present results are in agreement with the findings of other researchers fed different protein levels or protected methionine and using different breeds (Wiese *et al.*, 2003; Sahlu *et al.*, 1993; Hart *et al.*, 1993; Shahjalal *et al.*, 1992; Deaville *et al.*, 1992).

Table 5: The effect of feeding the different protein levels on the hair characteristics of the growing Shami kids

Treatments	**Diameter (um)**	**Length (cm)**	**Hair yield (mg/100 cm^2)**
Contrl	13.8	19.3 a	93.6 a
T[1]	12.9	14.9 b	59.61 b
T[2]	13.6	21.7 c	112.52 c
SEM[3]	0.59	1.23	5.68
Significancy	NS	**	***

1 75% of protein daily requirements
2 Dietary protein according to NRC+ 2.4 g protected methionine as *Smartamine*® .
3 Standard error of means.
NS Not significant
** P< 0..01
*** P< 0.001

5 CONCLUSION

The NRC recommendation level of protein for growing kids cover the requirements of growing Shami kids raised in the Mediterranean region with proper performance. Feeding protected methionine (*Smartamine*® above NRC requirements only affects the growth and yield of Shami Kids' hair. Regarding the mineral concentration, a significant effect of treatment, time and time X treatment is on cobalt status.

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