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Performance of Growing Crossbred Goats fed by-pass Methionine Raised under Semi Arid Condition

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Abstract: A study was conducted to evaluate the effect of feeding different levels of protein to growing crossbred kids (F1: 50% Shami breed x 50% baladi breed). Weanling crossbred kids (n=18; 75 to 90 days old) were selected and individually housed at our experimental farm. Kids were divided randomly to one of the three treatments. The three dietary treatments were: T1: Control ration, formulated according to NRC (1985) to cover the protein and other nutrients requirements. 2: T2, ration formulated to covered only 75% of protein recommended by NRC. 3: T3, Control diet + bypass methionine 2.4 g Smartamine®/day/ kid. Kids were individually fed ad libitum their respective diets for 12 weeks and feed intake were recorded daily for each kid. Initial and monthly body weights were also recorded. Blood samples were collected monthly and analyzed for metabolites and some trace minerals concentrations. At the end of the experiment, three kids from each treatment were slaughtered and kidney, liver and spleen were taken, weighted and samples collected, including meat, for further analysis. Data were analyzed using Complete Randomized Design with repeated measurements. Feeding crossbred growing kids bypass methionine above NRC recommendation significantly ($P<0.05$) improve final body weight, total weight gain, average daily gain and feed conversion ration when compared with the control and T1 groups. There was no significant effect ($P>0.05$) of treatments on mineral concentrations in blood serum, liver, kidney, spleen and meat samples. Furthermore, treatments didn't cause any significant effect ($P>0.05$) on cholesterol, albumin, total protein, glucose and creatinine levels in the blood serum, but affect meat quality measurements..
In conclusion, feeding bypass methionine above NRC protein recommendation level cause a significant improvement in performance of crossbred growing kids. Breed and environmental factors may affect protein and probably other nutrients requirements when compared with NRC recommendation. Further research is needed.
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1. Introduction

Sufficient supply of protein and well balance amino acids especially the most essential amino acid, methionine and lysine, is a very crucial factor for proper growth and productivity of ruminant animals. Breeds of sheep differ markedly in adaptability to different environments and in performance for traits, observed at the level of protein and amino acid kinetics in response to nutrient supply in major tissues, which influence efficiency of production and product quality. Characteristics of each breed have a genetic basis and can therefore be exploited in structured crossbreeding systems designed for specific production-marketing situations.

Goat is widely distributed in the Mediterranean region (Titi et al., 2008) as a major ruminant animal for meat production. Feeding 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 different goat 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 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.

Because of that, the broad goal of this proposal is to determine the effect of different levels of protein on the performance of growing crossbred (F1: 50% Shami x 50% baladi goats) growing kids raised under a semi arid Mediterranean region.

2. Material and Methods

Animals, treatment and sampling: Weanling crossbred kids (n=18 for each), about 75 to 90 days old, were individually housed at our research station, Faculty of Agriculture, and injected sub-cutaneously with 2 mls enterotoxaemia vaccine. Kids were divided randomly to one of the three treatments. The 3 dietary treatments will be: T1: Control ration, formulated according to NRC (1981) to cover the protein and other nutrients required. 2: T2, ration formulated to covered only 75% of protein recommended by NRC. 3: T3. Control diet + 2.4 g Smartamine® /kid/day top dressing.

Kids were individually fed ad libitum their respective diets (Table 1.) for 12 weeks and feed intake were recorded daily for each kid. 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. At the end of the experiment, three animals from each treatment were slaughtered and kidney, liver and spleen were taken, weighted and samples collected for further analysis. The cross sections of the logissimus dorsi (LD) muscle were collected from each slaughtered kid for meat quality evaluation. The dressing percentages of hot carcass were calculated for all slaughtered kids.

The biological samples were analyzed for the following: 1) Blood and tissues samples were prepared according to A.O.A.C. (1995) analyzed for mineral concentrations using Atomic Absorption Spectrophotometer (AAS; **Perkin- Elmer, 1981**); 2) Blood glucose, triglyceride, total protein, cholesterol, and creatinine were measured by using different available commercial kits.

Statistical analysis: Data were analyzed using the General Linear Model (GLM) of Statistical analysis system (SAS, 2010) as a complete randomized design (CRD) with repeated measurements. Protected LSD test was used to compare between means for significances.

3. Results and Discussion

Sufficient supply of protein and well balance amino acids especially the most essential amino acid, methionine and lysine, is a very crucial factor for proper growth and productivity of ruminant animals. Breed and environmental factors may affect protein absorption and amino acids kinetics by ruminant animals and probably other nutrients requirements when compared with NRC recommendation. So, it very crucial to investigate the effect of feeding different levels of protein above and below the NRC recommendation on the performance of crossbred kids raise in the semi arid Mediterranean region.

3.1. General performance of crossbred kids:

Feeding crossbred growing kids bypass methionine above NRC recommendation significantly ($P<0.05$) improve final body weight, accumulated total weight gain, accumulated average daily gain and decrease accumulated feed conversion ratio when compared with the control and T1 groups (Table 2.). Feeding bypass methionine above NRC protein recommendation level cause a significant improvement in performance of crossbred growing kids.

For the feed intake, the result was consistent with Prieto *et al.* (2000) and Chobtang *et al.* (2009) 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 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 crude protein 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 and feed ingredients composition and environmental factors are the reason for variation.

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 disagreed with crossbred results.

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).

According to previous studies regarding the dressing percentages, feeding high protein levels even in the form of undegradable protein did not cause any significant effect on dressing percentage (Shahjalal *et al.,* 2000: Rocha *et al.,* 2004; Choi *et al.,* 2007). Moreover, Wiese *et al.* (2003) reported that feeding

lambs protected methionine as Smartamine did not improve hot carcass weight and dressing percentage which agreed with the present finding (49.76, 49.49 and 49.86%, respectively).

3.2. Blood and tissues mineral profiles:

There was no significant effect (P>0.05) of treatments on mineral concentrations in blood serum, liver, kidney, spleen and meat samples, except Mn in spleen (Tables 3 and 4). 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 4.). 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 changes in term of increasing and decreasing trace minerals concentrations in different tissues and serum, but all values were within the normal levels according to Puls (1990) and Underwood and Suttle (2001).

3.3. Blood serum metabolites:

Treatments didn't cause any significant effect (P>0.05) on cholesterol, albumin, total protein, glucose and creatinine levels in the blood serum (Table 5.). Yousef and Zaki (2001), Shahen *et al.* (2004) and Abdel-Ghani *et al.* (2011) reported a positive correlation between dietary protein and serum total protein concentration in goats which disagreed with our finding for the crossbred kids. On the other hand, the findings reported by El-Reweny (2006) were consistent with our regarding the protein concentration in blood serum completely agreed with our finding regarding crossbred kids. Unfortunately, there are no previous studies reported regarding the effect of dietary protein levels using undegradable methionine to growing kids on blood cholesterol and total lipid profile. Thus, according to the findings of this experiment, feeding by-pass methionine as a sulfur amino acid at high levels can cause a great effect on fat metabolism of growing baladi kids in term of total lipids profile in blood serum.

3.4. Meat quality measurements:

Regarding the logissimus dorsi (LD) measurements and effect of treatment are shown in table 6. Feeding protected methionine, above NRC (1981) crude protein recommended level caused a significant reduction in LD muscle weight, fat weight and percentage, and back fat thickness, but on effect on meat dry matter and ash percentages compared with the control and T1. Wiese *et al.* (2003) reported a reduction in back fat thickness (BFT) with feeding protected methionine as Smartamine which consistent with our findings. Thus, feeding by-pass methionine as a sulfur amino acid at high levels can cause a great effect on fat metabolism in term of BFT andother measurement in the LD section. Moreover, protected methionine may play an important role in improving the lean meat production because of increasing the LD cut weight.

Table 1. Feed composition (As fed)

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.

Table 2: The effect of treatment on the performance of crossbred kids

	Initial BW		Final BW		AccGain[3]		AccADG[4]		AccFCR[5]		TFI[6]	
	X`	SD	X`	SD	X`	SD	X`	SD	X`	SD	X`	SD
Control	16.8	1.7	27a	1.3	10.4a	1.2	0.121a	0.01	6.8a	0.65	66.3a	3.8
T1[1]	17.6	1.2	27a	1.4	9.8b	1.3	0.116b	0.01	7.4b	0.74	70.7b	4.2
T2[2]	18.1	1.2	29b	1.4	11.9c	1.3	0.129c	0.01	5.9c	0.74	68.8c	4.2
Sign.	NS		*		*		*		*		*	

1 75% of recommended NRC of protein/

2. 2.4 g methionine/head/day above NRC protein requirements.

3 Accumulated gain

4 Accumulated average daily gain

5 Accumulated feed conversion ratio.

6 Total feed intake

NS= Not significant

Table 3. The effect of treatments on the minerals concentrations (µg/g wet weight) in different tissues of the crossbred kids

	Control	T1[1]	T2[2]	SE[3]	Significancy
Kidney					
Zn	0.025	0.029	0.023	0.002	NS
Fe	0.041	0.047	0.051	0.01	NS
Mn	0.0010	0.0006	0.0006	0.0001	NS
Cu	0.004	0.009	0.009	0.0004	NS
Liver					
Zn	0.037	0.039	0.032	0.014	NS
Fe	0.085	0.074	0.069	0.01	NS
Mn	0.003	0.003	0.004	0.0001	NS
Cu	0.008	0.02	0.01	0.002	NS
Spleen					
Zn	0.03	0.03	.08	0.02	NS
Fe	0.15	0.14	0.15	0.001	NS
Mn	0.002 [a]	0.001[b]	0.003c	0.0001	**
Cu	0.004	0.007	0.005	0.0001	NS
Meat					
Zn	0.034	0.031	0.035	0.002	NS
Fe	0.03	0.031	0.018	0.004	NS
Mn	0.003	0.001	0.004	0.0002	NS
Cu	0.003	0.003	0.004	0.0001	NS

1 75% of recommended NRC of protein/

2. 2.4 g methionine/head/day above NRC protein requirement

3 standard error of means

NS= Not significant

* P<0.05

** P<0.01

Table 4. The effect of protected methionine on the concentration of minerals in blood serum (ppm) of crossbred kids

Measurement	Time				SE[3]	TRT[1]	Time[2]	TRT * Time
	1	2	3	4				
Co	0.38	0.41	0.42	0.56	0.039	NS	***	NS
Cu	0.228	0.427	0.198	0.236	0.063	NS	***	NS
Zn	0.43	0.51	1.58	2.28	0.25	NS	***	NS

1 treatnment

2 time of taking blood samples (Monthly)

3 Standard error of means.

NS Not significant

* P<0.05

** P<0.01

*** P<0.001

Table 5. The effect of protected methionine on the concentration of nutrients in blood serum (ppm) of crossbred kids

Parameter	Time				SE	TRT	Time	TRT *Time
	1	2	3	4				
Cholesterol	6.53	6.38	67.5	62.6	5.5	NS	NS	NS
Albumin	3.01	2.51	3.31	2.64	0.22	NS	*	NS
Protein	6.51	5.69	6.26	6.66	0.36	NS	*	NS
Creatinine	1.76	1.35	1.43	1.47	0.20	NS	*	NS
Glucose	59.9	55.3	64.2	58.1	6.2	NS	NS	NS

1 treatnment

2 time of taking blood samples (Monthly)

3 Standard error of means.

NS Not significant

* P<0.05

4 **mg/dl**

5 **g/dl**

Table 6. The effect of protected methionine on the crossbred kids LD measurements

TRT	C	T1	T2	SE	Significancy
Dm %	25.2	27.8	25.77	0.6	NS
Ash % ww	0.538	0.674	0.613	0.05	NS
Fat	27.62a	22.40b	10.47c	3.8	*
Muscles wt. (g)	17.36a	17.6a	23.88b	3.4	*
Fat wt. (g)	4.12a	7.63b	3.07c	0.814	*
Average back fat thickness (mm)	4.17a	4.33a	2.89b	0.44	*

1 75% of recommended NRC of protein/

2. 2.4 g methionine/head/day above NRC protein requirement

3 standard error of means

4 Longissimus dorsi

NS not significant

* P<0.05

4. Conclusion

Feeding crossbred kids, raise under the semi arid conditions, bypass methionine above NRC protein recommendation level cause a significant improvement in their productivity and meat quality measurements especially the fat content. Breed and environmental factors may affect protein and probably other nutrients requirements when compared with NRC recommendation. Further research is needed.

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