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Full Length Research Paper

Effect of dietary crude protein level on the performance and apparent digestibility of Iranian Saanen kids

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The effects of increasing dietary levels of crude protein (CP) on growth, feed intake, feed efficiency and nutrient apparent digestibility on Iranian Saanen kids were studied. 24 Iranian Saanen weaned kids who were 86 ± 3 days old with live weight of 9 ± 03 kg were used in a completely randomized design. There were three treatments (n = 8 kids per treatment). The dietary treatments contained 35% lucerne hay with 65% concentrate supplement that consisted of 14, 15 and 16% CP for T1, T2 and T3, respectively (based on dry matter). The kids were housed in individual metabolic cages. Daily intake and body weight gain were determined and feed efficiency was calculated. Rumen fluid was collected by stomach tube and pH was immediately measured. The results show that, with increasing CP level in the diet, feed intake and body weight gain increased numerically, which was not significant (P> 0.5). Feed efficiency improved with increasing CP level. The effects of treatments on apparent digestibility were not significant (P> 0.5); but, ammonia-N and pH significantly increased with increasing CP level (P<0.5). No significant differences were observed between treatments for body measurement. Therefore, the results of this study show that increasing CP level from 14 to 16% improved performance in the Saanen kids.

Key words: Saanen kids, crude protein level, treatment, performance.

INTRODUCTION

Goats play an important role in Iran, largely as a source of red meat and milk. Iran has 25 million goats and kids (FAO 2003). Goat production is done by village people in a system of grazing on lands. Goat meat production system around the world is extremely diverse. Breed ranges in mature body weight from small tropical goat breeds of 9 to13 to large European dairy breeds and Boer goats, which can exceed 100 kg (Mioc et al., 2011). Dietary nutrient, especially energy and protein, are major factors affecting meat production in goats. Thus, a sufficient protein supply can improve growth and performance in goats. Optimum protein levels for achieving high growth and performance efficiency are variable. Prieto et al. (2000) reported that optimum protein levels for fatting of kids were about 14%, while Tite et al. (1999) reported that optimum protein levels for feedlot goats ranged from 16 to 20.3%. Negesse et al. (2000) showed that the kids fed with 8% dietary CP level had lower average daily gain (ADG) and dry matter intake (DMI) than the kids fed with 10.5, 12.8, 15.5 dietary CP levels. Hwangbo et al. (2009) reported that the kids fed with 18% CP in diet had significantly higher ADG when compared with the kids fed with 14, 16 and 20% CP in diet. Therefore, the objective of this study was to investigate effects of different CP levels on the growth and performance of Iranian Saanen kids.

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Abbreviations: CP, crude protein; **ADG;** Average daily gain; **DMI,** Dry Matter intake; **AIA,** Acid Insoluble Ash; **NDF,** Natural Detergent Fiber; **ADF,** Acid Detergent Fiber; **CRD,** complete randomized design; **FCE,** feed conversion efficiency.

MATERIALS AND METHODS

The experiment was carried out during spring season at Ferdowsi University of Mashhad, Iran. All the chemical analyses were done

Table 1. Composition of ingredients (%) used in concentrate mixture.

Ingredient	Treatment		
	T1	T2	T3
Corn grain	54	54	54
Cotton seed meal	14.5	20	25.5
Sugar beet pulp	30	24.5	19
limestone	0.6	0.6	0.6
Mineral Mix	0.9	0.9	0.9

The treatments were T1: 14, T2: 15 and T3: 16% crude protein, respectively.

Table 2. Chemical composition of experimental diet.

Composition (DM%)	Treatment		
	T1	T2	T3
DM	87.54	88.20	88.34
CP	14	15	16
NDF	30	29.7	29.1
ADF	19.2	19.2	19.1
ME(Mcal kg^{-1})	2.43	2.44	2.45
EE	2.6	2.6	2.6
Ca	1	1	0.9
P	0.5	0.5	0.5

The treatments were T1: 14, T2: 15 and T3: 16% crude protein, respectively.

in the laboratory of animal nutrition. 24 male and female Iranian Saanen weaned kids (12 male and 12 female) were used for this study. The kids were divided equally to three groups and eight animals (4 male and 4 female) per group. Each kid was confined in a separate digestion and metabolism crate during the entire experiment. Three rations with different crude protein ratio were designed as diet 1 (containing 14% CP), diet 2 (containing 15% CP) and diet 3 (containing 16% CP). The experiment period consisted of 60 days. The ingredient composition of the experimental diets and chemical composition of feed are shown in Tables 1 and 2, respectively. The dietary treatments contained 65% concentrate supplement and 35% lucerne hay.

Feed was offered once at 9:00 and daily records of feed offered and residues left were measured. Feed intake was calculated as the difference between the amounts of offered and feed refusal. The body weight and parameters were measured at an interval of 15 day prior to feeding and from the beginning until the end of the trial. Clean and fresh water was freely available to all the kids in the entire experiential period. During the last seven days of the collection period, feces and feed were collected. Samples of feed and feces were analyzed for dry matter (72 h at 60°C), ash (4 h at 550°C) and apparent digestibility were determined. The apparent digestibility was determined using method of acid insoluble ash (AIA), natural detergent fiber (NDF) and acid detergent fiber (ADF) content of the sample were determined according to the method of Van Soest (1991). Rumen liquor samples were collected from all kids at the interval of 15 days at 3 h post feeding using stomach tube, The ammonia-N content was determined using the Kjeldal method. The pH of rumen fluid was determined immediately using digital pH meter (Metrohm, 691). Rumen fluid strained through two layers of cheese cloth and acidified with 10 ml of HCl solution (50/50vol/vol) was determined to obtain the ammonia-N. The ammonia-N content was determined using the Kjeldal method.

Results of feed intake, growth and performance parameters were analyzed using complete randomized design (CRD) with three levels of protein. The data were analyzed using the GLM procedure SAS, (2000). Duncan's multiple range tests (p = 0/05) were used to determine statistical difference between treatment means (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

The effect of treatments on DMI is shown in Table 3. The difference between treatments on DMI was not significant (P> 0.5) but, DMI increased with increasing protein level. In general, it is well known that feed intake increases with the increase in dietary CP level protein (Huston et al., 1988; Cheema et al., 1991). Increasing CP level in the diet increased the average daily DMI from 448 to 608 g (Negesse et al., 2001). Jia et al. (1995) reported increased DMI in goats fed with higher levels of dietary CP. Hwangbo et al. (2009) reported that increasing CP levels from 14 to 20% had no significant effect on DMI. Pathak et al. (1992) reported increased forage DMI in captive black buck of berseem clover containing 20% CP when compared with oat having 13% CP.

The result obtained from this study is in agreement with Ahn and Moon (1985) and Choi et al. (2005) results; they reported no significant differences in feed intake when the sheep had diets with different CP levels ranging from 9 to 13% and when Korean black goats consumed diets containing 12 to 18% CP.

The effects of CP levels on ADG and feed conversion efficiency (FCE) were not significant. The ADG was greater for kids fed T3 when compared with T2 and T1. The higher ADG attained with the higher CP diet probably resulted from higher feed intake. Protein is an essential nutrient for animal growth and plays an important role in muscle growth and animal development (Mtenga and Kitaly, 1990). Negesse et al. (2000) found increase of ADG in Saanen kids with the diet containing 17.6% CP when compared with 14.4, 11.4 and 8.7% CP level. Fernandez et al. (1997) observed no significant difference in the mean average daily gain of goats fed with diets containing 65% and two levels of protein (9.5 and 14%). The variation in ADG and FCE in barbari kids was similar when fed with different protein levels in the diet (Dutta et al., 2009). Hwangbo et al. (2009) compared low feed efficiency for Korean black goats fed with 18% CP level with 20, 16 and 14% CP levels. In agreement with previous studies, increase of CP level increased ADG in Saanen kids.

The apparent digestibility of dietary CP level was not significantly different between the treatments (P > 0.5) (Table 3); however, the apparent digestibility of CP in the T1 group was lower than that of other treatments. Shahjalal et al. (2000) found that goats fed with high protein diet had significantly higher values for the digestibility of CP and EE when compared with those which received low protein diets. Ash and Norton (1987) reported that the feeding of high protein diet to goats significantly improved nitrogen digestibility when compared with the low protein diet. Atti et al. (2004) reported that kids fed with 12 and 15% CP level had

Table 3. Effect of CP levels on the performance and apparent digestibility of kids.

Variable	Treatment			
	T1	T2	T3	SE
DMI (g day^{-1})	478.5	480.2	519.75	17.5
Daily gain (g day^{-1})	88.06	93.53	102.79	3.2
Feed efficiency	5.42	5.18	4.90	0.21
Apparent digestibility (%)				
NDF	59.71	58.63	60.30	0.48
ADF	46.37	45.66	46.44	0.55
CP	75.83	77.85	77.27	0.85
OM	70.69	71.37	70.72	0.57

The treatments were T1: 14, T2: 15 and T3: 16% crude protein, respectively.

Table 4. Effect of CP levels on rumen fermentation and body measurement.

Parameter	Treatment			
	T1	T2	T3	SE
pH	6.26	6.42	6.61	0.49
Ammonia-N	22.38	24.34	26.60	0.84
Body measurement (cm)				
Body length	59.34	59.80	61.03	1.38
Wither height	54.22	54.48	53.75	1.11
Heart girth	63.21	62.95	63.87	1.85
Hip-pin interval	19.01	19.63	19.85	043

The treatments were T1: 14, T2: 15 and T3: 16% crude protein, respectively.

significantly high apparent digestibility for CP when compared with 10% CP levels. In contrast, kids fed with 10% CP levels had significantly high apparent digestibility for organic matter when compared with 12 and 15% CP level. They concluded that the lowest N level may have limited the development and activity of rumen microbes, whereas higher CP level might have stimulited microbial activity on fermentation and microbial protein synthesis.

The pH and ammonia-N concentration in the rumen fluid were significant for treatments and increased with increasing CP levels. Dutta et al. (2009) reported that increasing CP level from 12 to 14.1% had no significant effect on the increase of pH ammonia-N; they concluded that this increase could be probably due to higher incorporation of ammonia-N in the microbial protein. The higher concentration of ammonia-N and other nitrogen fractions with high protein was reported by Baik et al. (1997). Increasing rumen pH in the present study was mainly due to increased proteolysis, degradation of peptides and deamination of amino acids in the rumen. The effect of treatments was not significant on body measurement (P> 0.5) (Table 4).

Conclusion

The increasing CP levels from 14 to 16% in diet improved feed intake, average body gain and feed efficiency but had no effect on apparent digestibility of nutrients and body. Therefore, 16% dietary CP could be recommended for Iranian Sannen kids; however, higher ratios of CP should be tested.

REFERENCES

Ahn BH, Moon YH (1985). Effect of dietary protein and calcium levels on nutrition in sheep I. Effect of dietary protein and calcium levels on digestibility, nitrogen balance and some mineral retention in sheep. Kor. J. Anim. Sci. 27:507-514.

Ash AJ, Norton BW (1987). Studies with the Australian Cashmere goats. Aust . J. Agr . Res. 38:957-969

Atti NH, Rouissi H, Mahouachi M (2004). The effect of dietary crude protein level on growth, carcass and meat composition of male goat kids in Tunisia.J. Small Rumin, 54:89-97

Baik MG, Ha JK, Kim WY, Han IK (1997). Effects of different levels of concentrate incomplete rations on nutrient digestibility's and ruminal metabolites in sheep and growth performance in Korean native bulls. Asian-Aust. J. Anim. Sci. 10:371-377.

Cheema AU, Galyean ML, Caton JS, Freeman AS (1991). Influence of protein levels and naloxone on intake, nitrogen metabolism and digestion kinetics in lambs fed oat hay or barley straw. J. Small Rumin. Res. 5:35-46.

Choi SH, Kim SW, Park BY, Sang BD, Kim YK, Myung JH, Hur SN (2005). Effects of dietary crude protein level on growth and meat quality of Korean native goats. J. Anim. Sci. Technol. (Kor.) 45:783-788.

Dutta TK, Agnihotri MK, Sahoo PK, Rajkumar V, Das AK (2009). Effect of different protein-energy ratio in pulse by-product and residue based pelleted feeds on growth, rumen fermentation, carcass and sausage quality in Barbari kids. J. Small Rumin, 85:34-41

FAO (2003). Food and Agriculture Organization. Database available at www.fao.org.

Fernandez JM, Sahlu T, Lu CD, Ivey D, Potchoiba MJ (1997). Production and metabolic aspects of non-protein nitrogen incorporation in lactation rations of dairy goats. J. Small Rumin. Res. 26:105-117.

Huston JE, Engdahl GS, Bales KW (1988). Intake and digestibility in sheep and goats fed three forages with different levels of supplemental protein. J Small Rumin. Res. 1:81-92.

Hwangbo S, Choi SH, Kim SW, Son DS, Park HS, Lee SH, Jo IH (2009). Effects of Crude Protein Levels in Total Mixed Rations on Growth Performance and Meat Quality in Growing Korean Black Goats. Asian-Aust. J. Anim. Sci.Vol. 22, No. 8:1133-1139

Jia ZH, Sahlu T, Femandez JM, Hart SP, Teh TH (1995). Effects of dietary protein level on performance of Angora and cashmere-producing Spanish goats. J. Small Rumin. Res. 16:113-119.

Mioc B, Susic V, Antunovic Z, Prpic Z, Vnucec I, Kasap A (2011). Study on birth weight and pre-weaning growth of Croatian multicolored goat kids. VeterInarski Arhiv 81 (3), 339-347, 2011

Mtenga LA, Kitaly AJ (1990). Growth performance and carcass characteristics of Tanzanian goats fed Chloris gayana Hay with different levels of protein supplement. J. Small Rumin. Res. 3:1-8.

Negesse T, Rodehutscord M, Pfeffer E (2001). The effect of dietary crude protein level on intake, growth, protein retention and utilization of growing male Saanen kids. J. Small Rumin, 39:243-251.

Pathak NN, Kewalramani N, Kamra DN (1992). Intake and digestibility of oats (Avena sativa) and berseem (Trifolium alexandrinum) in adult black buck (Antilope cervicapra). J. Small Rumin. Res. 8:265-268.

Prieto I, Goetsch AL, Banskalieva V, Cameron M, Puchala R, Sahlu T, Dawson LJ, Coleman SW (2011). Effects of dietary protein concentration on postweaning growth of Boer crossbred and Spanish goat wethers. J. Anim. Sci. 2000, 78:2275-2281

Shahjalal MM, Bishwas AA, Tareque AMM, Dohi H (2000). Growth and carcass characteristics of goats given diets varying protein concentration and feeding level. J. Anim. Sci., Vol, 13. 5:613-618.