

Short Communication

Effect of dietary protein level on growth and body condition score of male Beetal goats during summer

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Abstract

The effects of feeding various dietary protein levels on the fattening of male Beetal goats were investigated. Twenty-seven bucks (initial bodyweight 35 ± 0.5 kg) between 12 and 16 months old were randomly assigned to one of three treatments. The treatments, which were provided as isocaloric supplements to 5 kg fresh sorghum fodder, differed in the amount of crude protein (CP), namely i) 18% CP (LP) ii) 25.5% CP (MP) and iii) 31.6% CP (HP). Feed intake and faecal score were recorded daily. Live bodyweight was recorded every 14 days. Withers height, heart girth, body length and body condition score were recorded monthly. Dry matter intake and average daily gain increased linearly with the level of CP in the diet. The average body condition score, withers height and heart girth were significantly greater in for goats in the HP group compared with those in LP and MP groups. However, dietary protein did not affect body length. Thus, feeding higher levels of CP linearly increased the growth, feed intake and feed efficiency of growing Beetal goats. The mean faecal score was lower for goats in the HP group compared with goats in the LP group.

Keywords: average daily gain, body measurements, faecal consistency

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Goats are an integral component of animal genetic resource. They have been associated with human beings since the dawn of agriculture. They were the first animals to be domesticated and are important in subsistence agriculture of tropical developing countries. Pakistan ranks third in the world for goat numbers (FAOSTAT, 2019) and has approximately 30 breeds of goat. Beetal goat is one of the most common and important goat breeds in Pakistan. In Pakistan, goats are raised by nomads or at household level, utilizing mainly free grazing of grasses and low-quality forages. The majority of kids are slaughtered at an early age without fattening. The demand for chevon production is increasing and in 2016–2017 a total of 701 000 tons of chevon was produced in Pakistan (Anonymous, 2019).

Pakistan is deficient in the feed resources that are needed for ruminant livestock in terms of protein, energy and dry matter (Habib *et al.*, 2016). This deficiency results in low animal productivity. Proteins are needed for synthesis of cell products such as enzymes, hormones, milk and hair. In ruminants, amino acids come from dietary protein, and nonprotein nitrogen and ruminal ammonia, which are synthesized into protein by rumen microbes (Ríos-Rincón, 2014). Nuno *et al.* (2009) reported that CP levels between 14% and 18% did not affect the live weight gain of Dorper and Pelibuey lambs. However, feeding 13% to 14% CP improved the average daily gain in growing lambs and kids compared with those that were fed 10%, but providing 18% CP in the diet was not of further benefit (Prieto *et al.*, 2000; Kioumarsi *et al.*, 2008; Chobtang *et al.*, 2009). Titti *et al.* (2000) concluded that live weight gain was significantly improved at 16% CP level compared with 12% CP in the diet. Negesse *et al.* (2001) found that dry matter intake and average daily gain were improved linearly in male Saanen kids with higher CP levels ranging from 8.7% to 17.6% in the concentrate.

However, few published studies have evaluated the effects of various CP levels on growth rates in indigenous Beetal goats. Thus, the objective of this study was to determine the effects of CP level on the performance of Beetal kids that were being fattened for slaughter.

The Small Ruminant Training & Research Centre (SRT&RC), Ravi Campus, University of Veterinary and Animal Sciences (UVAS), Pattoki, served as the experimental location. The research facility is situated in central Punjab Province, Pakistan, which is an irrigated plain belt. This experiment was performed during the dry sunny season from May to July. Ethical approval was obtained from UVAS Ethical Review Committee.

The length of the trial was 70 days, including a preliminary adjustment period of 14 days. Twenty-seven bucks were randomly assigned to one of three treatments (Table 1) in a completely randomized design. The treatments provided various levels of CP in an iso-caloric supplement. The daily diet of each animal consisted of 750 grams concentrate and 5 kilogram (kg) sorghum fodder.

Table 1 Ingredients and nutrient composition of concentrate supplements that were fed to three groups of Beetal goats

Ingredient, %	Treatments ¹		
	LP	MP	HP
Soybean meal	11.8	25.9	37.1
Canola meal	11.8	25.9	37.1
Corn ground	22.0	16.2	10.4
Wheat bran	49.4	24.3	6.9
Cane molasses	2.1	3.1	3.5
Fat	1.7	2.5	2.8
Sodium bicarbonate	0.6	0.9	1.0
Limestone ground	0.3	0.4	0.5
Mineral vitamin	0.2	0.3	0.4
Sodium chloride	0.2	0.2	0.3
<i>Analysed chemical composition</i>			
Dry matter %	88.8	89.2	89.5
Crude protein %	18.0	25.5	31.6
Metabolizable energy, MJ/kg	12.1	12.1	12.1
Ash %	6.1	7.5	8.2

¹LP 18% CP, MP: 25.5% CP, HP: 31.6% CP supplements

Green fodder and concentrate were offered in the morning at 07h00 daily and unconsumed feed was collected next morning to measure feed intake. Feed samples of fodder and concentrate were collected weekly for proximate analysis. Every sample was dried at 55 °C for 24 hours in hot air oven. Dry matter and CP were calculated according to the guidelines of AOAC (1990). To determine the ash contents of the ration, samples were burned in a muffle furnace at 650 °C for four hours. Live bodyweights were recorded on day 1 and subsequently every 14 days before feeding. Withers height (WH) was recorded with a vertical measuring tape adjusted with cross bar and levellers, whereas heart girth (HG) and body length (BL) were recorded with a simple measuring tape. All body measurements were recorded monthly in centimetres and were taken when the animal was standing squarely on a level surface. Body condition score (BCS) was recorded monthly on a 1–5 scale (Villaquiran *et al.*, 2005). Faecal score was recorded daily on a 1–5 scale (Dalton, 2018).

The data were analysed with a one-way analysis of variance model implemented with the Mixed Procedure of SAS (SAS University Edition, SAS Institute Inc., Cary, NC). The linear and quadratic effects were tested. Results were declared statistically significant at $P < 0.05$ and trends were noted at $P < 0.1$.

Dry matter intake (DMI) increased significantly in response to increasing protein levels (Table 2). The daily DMI was greater for goats that were fed the high protein supplement compared with those that were fed less protein. Abdelrahman & Aljumaah (2014), Sultan *et al.* (2010) and Ebrahimi *et al.* (2007) also reported increased DMI with increased levels of dietary protein. However, there are also reports of no increase of DMI in response to increased levels of dietary CP (Prieto *et al.*, 2000; Chobtang *et al.* 2009).

Daily weight gain was also significantly affected by treatment (Table 2) ($P < 0.05$). It was greatest for goats in the HP group (142 ± 1.46 g/day) compared with those in the MP (125 ± 1.46 g/day) and LP (111 ± 1.46 g/day) groups. These findings are consistent with the results of previous studies (Abdelrahman & Aljumaah, 2014; Sultan *et al.*, 2010). However, there is conflicting information in other studies (Nuno *et al.*, 2009). This disagreement might be due to seasonal differences (Lu *et al.*, 1987), as the study of Nuno *et al.* (2009) was carried out in a season with temperatures in the range of 5–31 °C, while the current study was conducted in summer when the temperatures ranged from 40 to 45 °C.

The BCS of kids supplemented with the high protein concentrate was significantly greater than those supplemented with the low protein concentrate. Body condition score is an indicator of the composition of weight gain (i.e., fatness) and health status. Because the higher CP diet increased ADG in the current study, this may explain the similar findings with BCS. Ghani *et al.* (2017) also reported that 16% CP in the diet increased the BCS of growing goats.

Table 2 Effect of feeding various dietary protein levels on growth, feed efficiency and body condition score of male Beetal goats

Variables	Treatments ¹			Standard error	P-value		
	LP	MP	HP		Treatment	Linear	Quadratic
Initial bodyweight (kg)	35.1	34.4	35.2	0.67	0.61		
Final bodyweight (kg)	41.8	42.5	43.7	-	-		
Average daily gain (gm/d)	111 ^a	125 ^b	145 ^c	1.46	0.01	0.01	0.11
Dry matter intake (kg/d)	1.28 ^a	1.31 ^{ab}	1.33 ^b	0.01	0.03	0.01	0.87
Feed efficiency	0.08 ^a	0.10 ^b	0.11 ^c	0.00	0.01	0.01	0.86
Body condition score	1.64 ^a	1.86 ^{ab}	2.06 ^c	0.12	0.07	0.02	0.93
Wither height (cm)	74.37 ^a	73.85 ^{ac}	79.26 ^b	0.77	0.01	0.01	0.05
Body length (cm)	72.06 ^a	73.47 ^a	73.66 ^a	0.56	0.41	0.23	0.59
Hearth girth (cm)	76.58 ^a	77.42 ^a	80.90 ^b	0.56	0.01	0.00	0.23
Faecal score	1.43	1.33	1.38	0.03	0.05	0.21	0.03

¹LP 18% CP, MP: 25.5% CP, HP: 31.6% CP supplements

The body measurements WH and HG indicated significant effects of treatments (Table 2), while BL was similar among treatments. The higher CP level in the diet resulted in greater weight gain and therefore significant increases in WH and HG. The current results support previous studies (Abdelgadir *et al.*, 1984; Patel *et al.*, 2009) that reported significant increases in body measurements, except for BL, in growing calves supplemented with protein. Vahora *et al.* (2012) reported similar findings from supplementation of protein to growing heifer calves. These results are in line with the principle that body measurements are positively correlated with bodyweight (Eyduan *et al.*, 2017).

Faecal consistency scores indicate the nutritional status and the activity of the digestive system of sheep and goats. A greater faecal score indicates wetter faeces, while a lower faecal score indicates more solid faeces, and the latter is more desirable. In the current study, the faecal scores were lower with high CP in the diet compared with low CP in the diet. These results indicate that low protein affects the activity of the gastro intestinal tract and results in the production of wet faeces. They are supported by the observation that greater protein intake improves digestion and indirectly reduces intestinal activity and the load of scouring Nematode worms. These factors contribute towards the desired faecal score in small ruminants (Waghorn *et al.*, 1999).

Conclusion

The current findings concluded that supplementation of CP in the daily diet is advantageous for growing Beetal goats as it improved the DMI, ADG, and growth performance of yearling male Beetal goats.

Authors' Contributions

IM, MNH and NA designed the experiment, MQS and HM carried out the analysis, MQS assisted with data analysis, IM and HM arranged the scientific content and IM and NA drafted the manuscript. All authors contributed editorial suggestions and supported the final manuscript draft.

Conflict of Interest Declaration

The contributing authors of this research study certify that they have no conflict of interest.

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