

Performance and Economic Efficiency of Young Anglo-Nubian Goat Fed Different Protein and Energy

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ABSTRACT: The aimed of this study was to assess the economic efficiency as well as the performance of young Anglo-Nubian goat fed different protein and energy on its concentrate. Twelve young female Anglo-Nubian goats weighing on average (\pm SE), 35.03 ± 3.91 kg, were divided into three groups (R1, R2 and R3), and received different levels of crude protein (CP) and energy (as total digestible nutrient-TDN) in concentrate diets for 12 weeks trial. R1=16% CP, 62%TDN; R2= 15% CP, 65%TDN and R3= 14% CP, 68%TDN. All animal also offered King-grass ad-libitum and 1kg of mixed forages. Feed intakes measured daily but live weights weekly. The experiment conducted in a completely randomized design. Input and output analysis applied in order to assess the economic efficiency. The result showed that The concentrate diets had significant effects on CP and TDN intakes ($p < 0.05$) but had not significantly ($p > 0.05$) influenced the DMI, ADG and FCR. The DMIs were 1338, 1358 and 1369 g/d for R1, R2 and R3, respectively. The CP and TDN intakes for R1, R2 and R3 were 230 and 961 g/d, 228 and 1000 g/d, 223 and 1036 g/d. The ADGs for R1, R2 and R3 were 150.9, 134.5 and 112.3 g/d with the FCR values were 8.87, 10.09 and 12.20, respectively. Economic analysis from the use of higher protein concentrate was having most profitable with an average of income over feed cost (IOFC) of IDR 2000/head/day. Therefore, it can be concluded that the concentrate (R1) can be used for growing young Anglo-Nubian goats.

INTRODUCTION

Population of goat in Indonesia was around 17.483 thousand heads, and increases gradually about 4.6% per year involving 3.5 million household farmers in 2011 (DGLS 2012). In Indonesia there are many goat breeds such as the etawah cross breed, gembrong, jawa randu, kacang, kosta and saanen. Farmers usually keep the animals for dual purpose, milk and meat, but only a few of them raise goats for milk.

Anglo-Nubian goat is a newly introduced breed in Indonesia, the information on the feed intake, nutrient utilization and its performance of this breed are scant in Indonesia. However, a few attempts have been made to determine their requirements for growth and maintenance of tropical breeds of goats such as Etawah goat grade, based on the nutrient requirement adopted from Kearn (1982).

Feed costs typically represent 70% of the production cost in animal production. As a necessary step to remain profitable goat producers should be monitoring and making decisions based initially on the 'income over feed costs' (IOFC).

Income over feed cost (IOFC) is a gross margin concept that can be used as a preliminary indicator of whether the fattening operation is viable in the short run. Ishler (2010) reported that income over feed cost could be used to manage profitability in dairy cattle operation with large seasonal variation milk production. It would be expected that the measurement would be similarly useful in beef cattle fattening operation.

The objective of this study was to analyze the economic efficiency on Anglo Nubian goat fed different protein and energy.

MATERIALS AND METHODS

The experiments were conducted in IRIAP. Twelve young female Anglo-Nubian goats between 12-18 months of age and pre-trial average live weight of 35.03 ± 3.91 kg were divided into three treatment groups in a completely randomized design with 4 replications. Three experimental concentrates diets were formulated at different crude protein (CP) and total digestible nutrient (TDN) levels: R1= 16%CP, 62%TDN, R2=15% CP, 65%TDN and R3=14%CP, 68%TDN. Animals were offered King grass ad libitum, 1 kg of mixed forages and 1 kg of concentrate diets for 12 week's trial. Table 1 shows the chemical composition of feed. Each animal was housed in a pen. Water were provided through a nipple in each pen. Feed intakes were measured daily, and live weights were measured by weekly. Parameters measured were nutrient (DM, CP and TDN) intake, average daily gain (ADG), feed conversion ratios (FCR) and Income Over Feed Cost (IOFC).

IOFC was measured in Indonesian rupiah per kid per day. Following Bailey *et al.* (2009), the IOFC is defined by the equation:

$$\text{IOFC} = \text{PKW} \times \text{ADG} - \text{DFC},$$

where

IOFC = Income over feed cost (IDR/kid/day)

PKW = Kid price of live weight (IDR/kg)

ADG = Average daily gain (kg)

DFC = Daily feed cost (IDR/kid)

Table 1. Chemical composition of feed (%)

Variables	Grass	Mixed forages	Concentrate diets		
			R1	R2	R3
Dry matter	29.38	40.56	88.94	88.23	87.78
Crude protein	9.09	20.56	16.21	15.28	14.33
Total digestible nutrient	67.20	74.44	62.15	65.14	68.41
Neutral detergent fiber	63.65	56.24	36.75	39.23	33.94
Acid detergent fiber	48.27	50.71	29.03	19.74	18.94
Calcium	0.34	1.39	0.91	1.05	0.99
Phosphorus	0.29	0.16	0.84	0.85	0.77

R1=16%CP 62%TDN, R2=15%CP 64%TDN, R3=14%CP 68%TDN

Statistical analysis. Feed intake, ADG, FCR and IOFC of goats were subjected to analysis of variance using General Linear Model (GLM) procedure of SAS (SAS Institute Inc., 2002). Differences between means were determined by Duncan's multiple range tests at significant level of $p < 0.05$.

RESULTS AND DISCUSSION

Kid Performance

Feeding of Anglo-Nubian goats with different levels of dietary protein and energy in concentrates had no effects on the DMI of grass and mixed forages ($p > 0.05$), but had effects on the DMI of concentrates ($p < 0.05$). Total DMI (grass, concentrate and mixed forage) were not different significantly ($p > 0.05$) among the treatment diets. The DMI in this trial was in the range values

of Kearn's recommendation, which the requirement for goats 40-50 kg of BW and 125 g ADG was 1.05–1.40 kg. In contrast, Aregheore (2003) reported that the total DMI intake (concentrate and forage) reduced with the increase in the levels of dietary energy and decrease in the levels of protein in crossbred Anglo-Nubian goats in Samoa. Abdelrahman (2013) also observed that decreasing the dietary level of protein from one to 0.75 time NRC's recommendation decreased the total feed intake in Shami goats.

Table 2. Nutrient intakes and performances of goats fed different levels of protein and energy.

Variables Intakes, g	Treatment of concentrate diets			SE	P value
	R1	R2	R3		
Grass	220	207	212	23.93	>0.05
Mixed forages	290	305	294	11.95	>0.05
Concentrate	827 ^c	847 ^b	863 ^a	9.04	<0.001
Total DM	1338	1358	1369	25.14	>0.05
Crude protein	230 ^a	228 ^{ab}	223 ^b	3.38	<0.05
TDN	961 ^c	1000 ^b	1034 ^a	17.61	<0.05
ADG (g/h)	150.90	134.50	112.25	30.96	>0.05
FCR	9.34	10.55	12.30	2.30	>0.05

R1=16%CP 62%TDN, R2=16%CP 65%TDN, R3=16%CP 68%TDN

SE= standard error

^{abc}Value followed by different superscripts in the same row differ significantly ($p < 0.05$).

Daily CP intakes of goats decreased with a decrease in the level of protein concentration ($p < 0.05$) (Table 2). There were significant differences on CP intakes between goats on R1 and R3 treatments; however, and the differences were not significant between goats on R1 and R2 ($p > 0.05$).

The mean protein intakes in this study was 227 g (14.12 g/BW^{0.75}) that were higher compared to Kearn's recommendation. Furthermore, the CPIs in this trial were higher compared to the total protein requirements for maintenance and gain as recommended earlier for young goats (Aregheore *et al.* 2003, Chobtang *et al.* 2009, Sahlu *et al.* 2004).

The TDN intakes of goats increased with a decrease the level of protein and increased the level of TDN in concentrates ($p < 0.05$). The highest TDN intakes obtained at the concentrate R3, followed by R2 and R1. The means TDN intakes in this study were higher compared to Kearn's recommendation for TDN intakes for goats but lower to previous results (Aregheore *et al.* 2003, Sahlu *et al.* 2004). Aregheore *et al.* (2003) estimated the optimal energy requirements in the diet for optimum performance of crossbred Anglo-Nubian goats was 13.4 MJ GE/kg BW (80.87% TDN). Sahlu *et al.* (2004) reported that the ME requirement of dairy goats for maintenance (MEM) and gain was 580 kJ/kg BW^{0.75} and 23.1 kJ/g ADG, respectively; these equal with 12.22 MJ/kg (80.91% TDN) for 40 kg of BW and 125 g of ADG. Similar result, Yagoub and Babiker (2008) observed, that the dietary energy level at 11.5 MJ/kg (72.2% TDN) produced the best performance of the female goat.

The ADG and FCR of the (R1). (R2) and (R3) were not statistically significant ($p > 0.05$). (R1) was better in ADG and FCR values than those goats on (R2) and (R3). Decrease of dietary protein by one % and increase TDN by three % levels slightly induced a reduction in growth rate and FCR. These changes in live weight might be due to the better response on the changing of

protein than energy in diets (Abdelrahman 2013, Chobtang *et al.* 2009, Lu and Potchoiba 1990, Lu *et al.* 2008, Sharifi *et al.* 2013, Tameem Eldar *et al.* 2012).

Income over feed cost (IOFC)

Weller (1994) reported that live weight gain is highly correlated with feed efficiency for growing animals. The average daily growth rates had a direct effect on the IOFC achieved in these growing operations. Table 3 shows the result for IOFC for Anglo Nubian kid. Group (R1) which was fed highest protein content was almost two time higher IOFC than two others group but not significantly different among other group ($P>0.05$) at 2000 IDR/day. This was because the growth rate of group R1 was higher than group R2 and group R3 and this growth rate was more than sufficient to offset the greater expenditure on feed.

Table 3. IOFC of goats fed different levels of protein and energy

Variables	Treatments			SE	P Value
	R1	R2	R3		
Diets					
-King grass	749	705	722	171	>0.05
-Mix Forages	1.072	1.128	1.087	259	>0.05
-Concentrate	3.719	3.581	2.774	784	>0.05
Total Feed Cost	5.541	5.413	4.583	1215	>0.05
ADG	151	135	112	30.96	>0.05
Total Income	7.545	6.725	5.610	1548	>0.05
IOFC	2.004	1.312	1.027	332	>0.05

SE= standard error

abcValue followed by different superscripts in the same row differ significantly ($p<0.05$)

This IOFC finding was lower to previous study by Krisnan (2013) that shown on boer goat fed 13% protein concentrate has given IOFC 2945 IDR/head/day. Supriyati *et al.* (2015) had reported that Etawah Goat grade given the highest IOFC of 1387 IDR/head/day being fed by Zn on its concentrate. These figures indicated that changes in feed price due to changes in feedstuff influenced goat performance, i.e. growth rate, and was a significant factor contributing to fluctuations in goat fattening cost of gains and its profit.

CONCLUSIONS

The different level of protein in the concentrates affected the nutrient intake but did not affect the ADG and FCR of young female Anglo-Nubian goats. Economic analysis from the use of higher protein concentrate was having most profitable with an average of income over feed cost (IOFC) of IDR 2000/head/day.

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