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Performance of Male Crossbred (Saanen×Local) Goats Fed Concentrate Diet

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ABSTRACT

The aim of this study was to assess the performance of concentrate feeding on intake and growth rate in goats. A total of 14 non-castrated male crossbred (Saanen×Local) goats of approximate age of 6 months and average initial live weight of 23.5±3.8 kg were used in a completely randomised design. The animals were divided into two treatment groups: control group and concentrate group. Both groups were fed their respective diets *ad libitum* throughout the experiment. The goats on the concentrate diet were also supplemented daily with 400 g fresh Napier grass variety for each animal. Chemical composition of the diets, intake and growth rate of the goats were evaluated. No differences ($p>0.05$) were observed in dry matter and organic matter intakes except for crude protein (CP) and neutral detergent fibre (NDF) ($p< 0.05$). The control group showed higher intakes of CP and NDF compared to the goats in the concentrate group. However, no differences were observed ($p>0.05$) in the growth performance and feed conversion ratio between the control and concentrate groups. There was no significant effect on daily weight gain of the goats fed the concentrate diets, suggesting that corn and soya waste with 400 g fresh Napier grass can support moderate weight gain in Saanen crossbred goats.

Keywords: Concentrate feeding, crossbred goat, feed intake, growth rate, soya waste

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INTRODUCTION

There is potential to exploit goat rearing in Malaysia to meet local demand for meat and milk. However, the performance of local goats is poor. Therefore, crossbreeding with high-yielding goats has been practised to improve the performance of local goats (Hirooka et al., 1997; Ariff et al., 2010). It is known that Saanen goats can enhance the productive performance of local goats through crossbreeding. Compared to local goats, Saanen crossbreds usually show better performance in milk production, birth weight of kids and daily weight gain (Sahni & Chawla, 1982).

For raising meat goats, one of the important factors in maintaining economic viability is how quickly and efficiently goats grow. High growth rate and efficiency decreases the time that it takes the kids to reach market weight, which in turn decreases the labour and feed cost associated with raising goats. Weaning kids receive their nutrition from two different sources: roughage and concentrate. In Malaysia, grass production is limited due to low soil fertility and lack of natural grassland (Chee, 1989). Farmers face shortage of grass especially during the dry season (Khaing et al., 2015). To overcome feed shortage during the dry season, more concentrates are usually offered to ruminants compared to the amount of roughage.

In this study, the treatment diet was composed of minimum ingredients such as corn and soya waste. Corn was characterised as energetic feed, while soya waste was characterised as inexpensive protein-rich feed (Rahman et al., 2014). It was hypothesised that a high-energy and high-protein diet would improve feed conversion efficiency by reducing feed intake. Therefore, the objective of this study was to evaluate the effect of concentrate feeding on intake and growth performance of male crossbred (Saanen × Local) goats.

MATERIALS AND METHOD

Experiment Site

The experiment was conducted from March to June 2015 at the Rumpun Asia Sdn. Bhd. (RASB) goat farm, Selangor, Malaysia. The latitude, longitude and average annual temperature were 3°28′ N, 101°38′ E and 28.3°C, respectively. The experiment procedure was entirely conducted according to the guidelines of the Institutional Animal Care and Use Committee of University of Malaya.

Experiment Design

A total of 14 non-castrated crossbred (Saanen×Local) males approximately six months old and with a mean initial liveweight (LW) of 23.5±3.8 kg were used in this study. The crossbred goat (Saanen × Local) was first crossed from a pure Saanen male goat and 'kacang' female goats. Before starting the experiment, the animals were dewormed. The animals were divided into two groups, with seven animals in each

group. The animals were individually kept in a single pen and fed for 98 days (14 days of adaptation and 84 days of evaluation) with two dietary treatment groups containing iso-caloric and iso-nitrogenous diets, namely: (i) control group (consisting of Napier grass, cracked corn and soybean) and (ii) concentrate group (consisting of cracked corn and soya waste). The animals in both groups were given the experiment feed twice a day, provided *ad libitum* to allow for 10% of refusal. To maintain rumen microbial activity and to prevent the risk of ruminal acidosis, the goats in the concentrate group were also given an additional amount of chopped Napier grass (400 g fresh/animal/d), which contained 22.1% dry matter (DM), 8.2% ash, 7.5% crude protein (CP) and 67.3% neutral detergent fibre (NDF) in DM form. The goats received an adequate supply of water and mineral blocks throughout the experiment. Soya waste (also known as okara) is an industrial by-product; in this study, it was supplied twice a week by a local supplier, stored anaerobically in containers. The corn and soybean were purchased locally.

The diet was formulated using the LUGRE programme (Langston University Goat Research Extension), which predicts the nutritional requirements of goats. It was estimated that the daily DM intake per goat would be 4% of the LW and the daily LW gain would be 100 g. The daily metabolic energy (ME) and CP requirements were calculated to be 7.9 MJ and 73 g, respectively. The daily feed intake was measured by weighing of daily offered feed and refusal of individual goats. To estimate intake, samples of offered feed and refusals were dried in an oven once a week for DM analysis. The goats in the concentrate group refused an average of 95±7.5 g DM feed/goat/d of their total diet, while the goats in the control group refused an average of 130±28 g DM feed/goat/d of their total diet. The goats in the concentrate group consumed all the offered Napier grass, while the goats in the control group refused about 68 g DM Napier grass/goat/d of their total refused diet, which included about 52% Napier grass, mostly the stem. The composition of feed and chemical composition of the experiment diets are presented in Table 1. The goats used in the experiment were weighed every 14 days using a weighing balance. The daily LW gain was calculated by difference between the initial LW and final LW of the individual goats and then divided by the experiment period.

Table 1
Composition and nutritive values of the experiment feeds

Items	Experiment group	
	Control group	Concentrate group*
Ingredients		
Napier grass (% DM)	28	-
Corn (% DM)	52	60
Soya waste (% DM)	-	40
Soybean (% DM)	20	-
Total	100	100
Nutrients		
Dry matter (%)	48.3	40.3
Organic matter (% DM)	96.1	97.8
Crude protein (% DM)	15.9	15.6
Neutral detergent fibre (% DM)	35.0	26.7
Total ash (% DM)	3.9	2.2
Metabolisable energy (ME) (MJ/kg DM)¶	11.8	12.3

Calculated ME value (MJ/kg DM) = 0.016 DOMD [g digestible organic matter/kg DM (AFRC 1998)]. Since DOMD was not determined in this study, the ME values are calculated from data published by several researchers who followed the methods developed by AFRC (1998) for estimating ME of Napier grass, corn, soybean and soya waste. DM, dry matter; MJ, mega joule.
*Goats received additional 400 g fresh Napier grass/animal/d, which contained 22.1% DM, 8.2% ash, 7.5% crude protein and 67.3% neutral detergent fibre on DM basis. These values were not reflected in the ration composition

Chemical Analysis

During the experiment period, samples of the feed were collected once a week and dried for 48 h at 70°C. Samples were ground to pass through a 1-mm sieve and then analysed for DM, ash and CP following AOAC methods (2005). The NDF was determined on ground samples following the methods of Van Soest et al. (1991). The results of the chemical analysis of the experiment feed ingredients are shown in Table 2.

Table 2
Chemical composition of experiment feed ingredients

Items	Dry Matter (%)	Organic Matter (%)	Crude Protein (%)	Neutral Detergent Fibre (%)	Ash (%)
Napier grass	22.1	91.8	7.5	67.3	8.2
Corn (cracked)	89.8	98.6	9.7	26.0	1.4
Soybean	90.0	95.1	44.0	13.0	4.9
Soya waste	22.1	96.6	23.5	27.8	3.4

Statistical Analysis

Measurements of feed intake and growth performance of the goats were subjected to repeated measures design using SPSS (version 12.0) based on the following model:

$$Y_{ijt} = \mu + T_i + \alpha_j + \beta_t + e_{ijt},$$

where Y_{ijt} = an observed value for measurement taken from animal j receiving treatment i at time t; μ = the overall mean; T_i = the mean effect of dietary treatment i; α_j = the fixed effect of initial body weight of animal j; β_t = the random effect of the measurement taken at time t; e_{ij} = the residual error.

RESULTS

Table 3 represents the effects of dietary groups on the feed and nutrient intake of the experiment goats. There was no significant difference ($p>0.05$) on total DM and OM intake between the diets evaluated. However, there were significant differences ($p<0.05$) in the intake of CP and NDF between the diets. The intake of CP was 177 vs. 162 g/d for the control group and the concentrate group, respectively, while the NDF was 378 vs. 326 g/d for the control group and the concentrate group, respectively. Clearly, the intake of CP and NF was higher ($p<0.05$) among goats in the control group than among those in the concentrate group.

Table 3
Dry matter and nutrient intakes of goats as affected by experiment feeds

Parameter	Experiment Group	
	Control Group (Mean ± SD)	Concentrate Group (Mean ± SD)
Intake		
Dry matter (g/head/d)	1113 ± 220.8[a]	1036 ± 205.5[a]
Dry matter (kg/d, % LW)	3.89 ± 0.5[a]	3.77 ± 0.5[a]
Organic matter (g/head/d)	1070 ± 211.3[a]	1006 ± 198.7[a]
Crude protein (g/head/d)	177 ± 33.5[a]	162 ± 30.7[b]
Neutral detergent fibre (g/head/d)	378 ± 81.2[a]	326 ± 70.0[b]

Means with the same superscript letters in the row are not significantly ($p>0.05$) different from each other. LW, liveweight; SD, standard deviation

Table 4 shows the effects of dietary treatment on the growth performance and feed conversion ratio of goats during the experiment period. No significant difference ($p>0.05$) was found on the initial LW (23.7 vs. 23.3 kg), final LW (33.6 vs. 31.6 kg) and daily LW gain (118 vs. 99 g/d) between the control group and the concentrate group, respectively. Similarly, no differences ($p>0.05$) were observed in the feed conversion ratio (9.6 vs. 10.5) between the control group and the concentrate group, respectively.

Table 4
Growth performance of goats affected by experiment feeds

Parameter	Experiment Group	
	Control Group (Mean ± SD)	Concentrate Group (Mean ± SD)
Initial LW (kg/head)	23.7 ± 3.8[a]	23.3 ± 3.8[a]
Final LW (kg/head)	33.6 ± 4.6[a]	31.6 ± 4.3[a]
Net gain of LW (kg/head)	9.9 ± 1.8[a]	8.3 ± 1.5[a]
Average daily LW gain (g/head)	118 ± 21.3[a]	99 ± 17.9[a]
Feed conversion (kg DM/kg gain)	9.6 ± 1.4[a]	10.5 ± 1.5[a]

Means with the same superscript letters in the row are not significantly ($p>0.05$) different from each other. LW, liveweight; SD, standard deviation; DM, dry matter

DISCUSSION

Slow growth rate is considered one of the major limiting factors in goat production. It may markedly improve by supplying the plane of nutrition. In this experiment, goats in the control group and the concentrate group gained LW at a rate of 118 and 99 g/d, respectively. Liveweight gain indicates that goats in both groups received a sufficient amount of energy and protein for maintenance and growth from their diet. The LW gain, however, was lower than the values obtained in the Saanen×Hair goat (140 g/d) by Gokdal (2013); this may have been due to not only diet but also genetics. Paengkoum et al. (2004) also observed LG gain that was similar to the results of this study.

Nutrition plays a vital role in improving LW; however, the degree of response varies with breed or type (Devendra & Burns, 1983). The range of DM intake was 3.77-3.89 kg/d (percentage of LW) for both groups, and this could be due to the chemical composition of the corn, soybean and soya waste, which had high amounts of energy and protein, and this attracted the goats to consuming more of this feed. This statement might be explained by the findings of Wiese et al. (2003), who suggested that higher DM intakes could be due to an availability of nutrients that are degraded by rumen microorganisms. The soya waste that partially replaced the Napier grass did not alter the intake of DM and OM, even with a lower intake of CP and NDF for a diet with soya waste. This probably occurred because of the slightly lower content of CP and NDF in the diet of the concentrate group, which may have contributed to intake without CP and NDF by the goats. In addition, the goats in the concentrate group received Napier grass (88.4 g DM/d/goat) to prevent acidosis, and this amount of Napier grass was not reflected in the table of ration composition (Table 1); the Napier grass contained only 7.5% CP, and this might have also contributed to lower CP intake by the goats in the concentrate group. However, higher NDF intake by the goats in the control group did not attribute to significant growth difference between

the groups; this is in line with the findings of Sheridan et al. (2000), who reported that Boer goats showed no significant difference in LW gain when fed diets of low (2.14 Mcal/kg DM) and high energy (2.60 Mcal/kg DM). Similarly, our finding is also in line with the previous results of Prieto et al. (2000), who reported that excess CP intake of the goats did not affect the growth rate of the kids.

On the other hand, it is known that increased NDF digestibility can exhibit in higher digestible energy and may subsequently lead to higher LW gain, but no digestibility trial was conducted in this study. Rahman et al. (2016) reported that goats fed a soya waste-supplemented diet showed improved NDF digestibility, which supported our present findings that there was no difference in BW gain between the two diets, even though the goats fed a concentrate diet (included soya waste) showed lower NDF intake. Soya waste contains 24.5% CP and 73% total digestible nutrients, and it is an inexpensive source of nutrients for animal consumption (Rahman et al., 2016). The results implied that both diets in the present study were sufficient to provide enough nutrients to increase the LW gain of the goats. Greater quantities of Napier grass can be replaced with soya waste in diets for Saanen crossbred goats without any adverse effects on their growth performance. The findings from this study provide useful information on the choice of diet depending on economic benefit, ease of use and forage availability.

CONCLUSION

The goats fed a concentrate diet had lower CP and NDF intake compared to the goats fed control diet, while no significant differences were observed in DM and OM intake. No significant differences were observed in the final LW, average daily LW gain and feed conversion ratio. These findings suggest that a concentrate diet may be useful for goat production, especially during the dry season when forage supply is limited.

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