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Effect of varying levels of concentrate to roughage ratio on growth of Sudanese desert kids

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Abstract

Thirty two male kids were divided randomly into four groups of 8 animals in each group. Animals were randomly allotted to four rations (A, B, C and D). The experiment lasted for 35 days. The rations fed to four groups consisted of different levels of concentrate to sorghum straw. Parameters studied were feed intake, daily weight gain, feed conversion ratio and degradation of dry matter and crude protein. Average daily dry matter intake was non significant. The results indicated that daily live weight gains and feed conversion were significant. Dry matte degradability was higher in ration A while crude protein degradability was higher in ration D. This study indicated that high concentrate to low roughage ratio showed high weight gain and low degradation of crude protein and dry matter.

Key words: Feed Intake, Weight Gain, Feed Conversion Ratio, Degradation

Introduction

Goats are the most widely distributed domestic livestock, and mainly found in tropical and sub- tropical regions. They can survive in areas with low quality vegetation. Goats are important to tropical farmers because they provide milk, meat and skin. Goat meat is preferred in most African and Arab countries for its taste and because it has a higher lean and lower fat percentage than mutton and beef. Sudan goats are mainly kept in small number in villages or towns. And it has been shown that an increase in concentrate supplementation is an efficient way to increase dry matter and nutrient intake of animal (Kalra et al., 1977).

In Sudan goat meat is consumed in most rural areas, particularly during religious, celebration. The aim of this investigation was to determine the degradability of the rations under study.

Materials and Methods

Thirty-two entire male kids of Sudanese desert goat's type were used in the study; ranged in age between 2.5-3.0 months and live weight varied between 8-11 kg. On arrival from market they were rested, watered, ear tagged, weighed individually and were randomly allotted to four groups each group of eight animals. All animal were allowed on preliminary period of 7 days during which they were fed sorghum straw and concentrate. During the preliminary period the animals were injected with antibiotics and swallowed antithelmintics (Bendazole).

The ingredients and chemical composition of each of the four rations were shown in Table 1. Rations were prepared in a mash form and fed to animals at 9 a.m. daily. Representative samples of rations were taken after formulation and proximate analysis was made on dried ground samples as outlined by (AOAC 1990). Green fodder (*Medicago sativa*) was offered at rate of one kilogram weekly as vitamin A source. The residue was weighed before the new ration was offered. Four rations containing concentrate (sorghum grain, groundnut cake, sorghum straw, lime stone and common salt were used. The four rations contained different concentrate to roughage ratio namely 75: 25, 60: 40, 50: 50, 40: 60 and were designated as A, B, C and D respectively. All animals weighed weekly, the initial live body weight was recorded on first day of the experiment. The experiment lasted for 35 days and the animals were weighed every other week. Refusal or (feed back) was collected daily before offering the new ratio. Feed intake for each group of animals was recorded daily.

The degradability study of the experimental diets was carried out in fistulae according to the polyester bag technique (Mehrez and Qrskov 1977). Nylon bags of 30 cm^3 weighing 3-4 g were used for incubation of the experimental rations. Empty bags were washed, oven dried at 60°C for 24 hours then weighed individually. Three grams of dry matter of ration samples were put in the bag then tied with nylon ribbon and introduced into a plastic tube of 8 cm length above the fistula level to ease movement of the bags inside the rumen. The bags were incubated for different period time 0, 6, 12, 24, 36 and 48 hours. They were immediately removed at the end of incubation period and washed under tap water and dried in a forced draft oven over night. The dry matter at zero time (soluble fraction) was estimated as the washing loss of sample weighed into nylon bag and cleaned under the running tap water. The residual samples after incubation of each time was individually mixed and prepared for approximate analysis. The degradability kinetic of experimental ration described as a curve-linear regression of dry matter or crude protein loss from the bag with time according to (Qrskov and Mc Donald 1979).

$$P = a + b\,(1-\exp^{-ct}) \qquad (I)$$

Where: P= potential degradability, t= incubation time, a= axis intercept at time zero represents soluble and completely degradedable substrate that is rapidly washed out of the bag.

b= the difference between the intercept (a) and the asymptote. Represents the insoluble but potentially degradable substrate which is degraded by the microorganism according to first order kinetics and c= rate constant of b function.

a, b, c are constant fitted by an interactive least squares procedures.

An estimation of effective degradability can be calculated according to (Orsckov and Mc Donald, 1979).

$$\text{Effective degradability} = a + \left[\frac{bc}{c+k}\right]$$

Where a, b, c, as defined for equation (I), k: rumen particle out flow rate. Then a graph was plotted by the fitted values of dry matter disappearance % against time of incubation in hours to form a curve.

Statistical analysis

Data were analyzed by analysis of variance according to general linear models procedures SAS (1994). Duncan's multiple range tests was used for mean separation.

Results

The daily feed intake was 409.8, 434, 443.9 and 431.3 kg for groups A, B, C and D, respectively. No significant differences found among the studied groups. The final live weight of kids was 13.6, 12.9, 12.4 and 11.8 kg for group A, B, C and D, respectively, however group D was significantly lower. The average daily live weight gain was 75.1, 58.1, 42 and 23.1 g/day for group A, B, C and D respectively. Significant differences were observed between feeding groups A, B, C and D in daily live weight gain. Feed conversion ratio was 5.5, 7.6, 10.7 and 18.9 for the same groups. However, significant differences were observed among groups (Table 2).

Table 1: Ingredients and chemical composition of rations fed to desert goat's kids.

Items	Rations			
	A	B	C	D
Ingredients (%)				
Sorghum grain	55	36	23	10
Groundnut cake	18	22	25	28
Sorghum straw	25	40	50	60
Lime-stone	1	1	1	1
Common salt	1	1	1	1
Total	100	100	100	100
Chemical compositions (%)				
DM	95	95.6	95.7	95.2
CP	17.1	17.0	17.0	17.1
Fiber	11.7	27.2	24.2	30.7
Ash	6.5	9.2	8.7	12.7
ME (Mj/kg DM)	11.4	10.2	9.6	8.8

In this and subsequent tables A, B, C and D: Concentrate to roughage ratio 75: 25, 60: 40, 50: 50, 40: 60 respectively

Table 2: Average feed intake, daily gain and feed conversion ratio of four groups.

Parameters	A	B	C	D	SE
Initial live weight (kg)	10.97	10.94	10.95	10.97	0.18
Final live weight (kg)	13.6^{a}	12.9^{ab}	12.4^{ab}	11.8^{c}	0.10
Daily feed intake (gm)	409.8	434.0	443.9	431.3	24.7
Daily live weight gain (gm)	75.1^{a}	58.1^{b}	42.0^{bc}	23.1^{c}	5.24
Feed conversion ratio	5.5^{c}	7.6^{b}	10.7^{b}	18.9^{a}	1.49

$^{a-c}$ means with different superscripts in the same row were significantly different ($P<0.05$).

Mean proportion of dry matter disappearance from different rations at different time of incubation in rumen were plotted graphically in figure (1). Estimates of constant, a, b, c equation potential degradation and effective degradation were shown in Table (3). Mean proportion of crude protein loss from different rations at various incubations time in rumen were represented graphically in Figure (2). Estimates of constant, a, b, c equation potential degradation effective degradation were shown in Table (4).

Table 3: DM degradability kinetics of four rations

Parameters	A	B	C	D
Readily degradable fraction	16.8	21.4	24.7	27.4
Slow degradable fraction	53.2	33.6	43.4	64.0
Rate of degradable fraction	0.05	0.09	0.05	0.02
Potential degradability	70.0	55.4	68.1	91.4
Effective degradability 0.02	54.6	49.3	56.1	58.0
Effective degradability 0.05	42.9	43.4	46.9	44.6

Table 4: CP degradability kinetics of four rations

Parameters	A	B	C	D
Readily degradable fraction	20.3	18.2	28.9	42.3
Slow degradable fraction	44.4	44.1	44.3	40.0
Rate of degradable fraction	0.04	0.03	0.06	0.07
Potential degradability	64.7	62.3	73.2	82.3
Effective degradability (0.02)	59.6	59.3	67.1	75.7
Effective degradability (0.05)	53.8	55.5	60.5	69.1

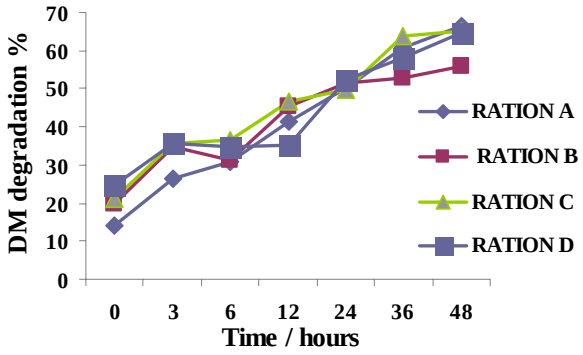

Fig1: DM degradability of experimental rations.

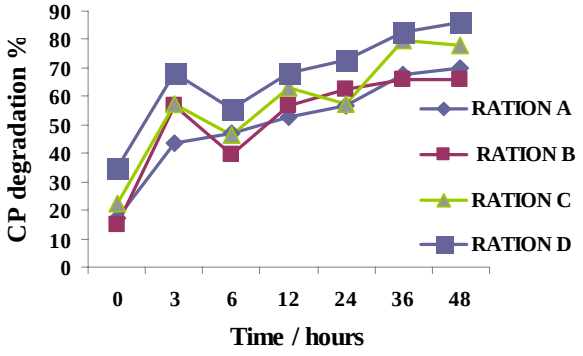

Fig. 2: CP degradability of experimental rations.

Discussion

Daily feed intake in the current study was lower than that reported by Adam et al. (2010), who recorded 461.62g. Significant differences were found among experimental groups for the daily live weight gain (table 2). Daily weight gain was higher in diets A (11.4 Mj/kg DM) and B (10.2 Mj/kg DM) than those reported by Salwa (1996), who stated 48 and 38g daily weight gain for kids fed 12.2 and 10.3 Mj/kg DM, respectively. Devendra and Burns (1983) reported 50g average daily weight gain for the tropical goats; this was lower than the present values for ration A and B. While, Awadelkarim (1997) reported that live weight gain, 54, 44, 39 and 20g/day for male desert goats which were lower than those in diet A and B in the present work.

Animal fed 75% concentrate (group A) and those fed 60% roughage (group D) showed 13.6 and 11.8 kg final live weight respectively which were lower compared to the findings reported by Ameha Sebsibe et al. (2007) and Adam et al. (2010) who indicated 17.5 and 16.36 kg, respectively in similar studies. In the current study, feed conversion ratio for four groups ranged from 5.5 to 18.9. These findings were confirmed by the results studies of Babiker et al. (1985) and Salwa (1996).

The results of degradability showed no differences (P>0.05) among groups, these may be due to small differences in metabolizable energy levels used in the current study which was probably not able to attain statistical differences. Dry matter and crude protein disappearance was higher in group D and lower in group B. These findings were in line with Klop Fenstein et al. (1991) and Hag Elkhider (1988). The highest effective degradation at (0.02) and (0.05) found in group D, while group A and B showed the lowest values (Table 4).

In sacco dry matter degradability of experimental rations were increased by increasing of incubation time, however there were some fluctuations in crude protein degradability. Thus, crude protein degradability was higher in ration A at all the tested hours (0-48) of incubation time. It varies from 34.6 to 84.8% in ration A across the incubation hours (Figure 2). These results were in accord with the results stated by Sultan Singh et al. (2010).

Conclusion

This study indicated that high concentrate to low roughage ratio showed high weight gain and low degradation of crude protein and dry matter, which influenced by the diets. Furthermore, high concentrate to low roughage ratio had appeared effective in the growth performance according to the significant differences in final live weight, daily gain and feed conversion ratio.

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