UTILIZATION OF SOME ORGANIC WASTES AS FEED SUPPLEMENT FOR GROWING GOATS UNDER DESERT CONDITIONS

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SUMMARY

A feeding experiment was conducted for 150 days, to evaluate the effect of two types of feed supplements contained some organic wastes on the performance of goats. Eighteen growing Black Desert male goats of average 18.7± 0.21 kg were randomly assigned to three groups (6 animals each). All groups were given berseem hay to cover 50% of maintenance energy requirements . Each group was offered one of three supplements.

The tested diets of R2 and R3 included 35% date seeds, 27% olive pulp + 8 molasses plus 30% redycill (R2) and 30% broiler litter (R3) and were given to goats *ad libitum*, whereas those in control group (R1) were given (CFM) to cover the nutritional requirements of 100 g gain / day.

Chemical composition, nutrient digestibilities, feeding values, body weight gain, feed efficiency and mean value of rumen metabolites were obtained. The results showed that :

The maximum voluntary intake of supplement was noticed by goats fed R2. Nutrient digestibilities of R1 were higher than the other tested diets except that of DM and EE. Also R1 showed higher feed values compared to the other diets. All animals were in positive nitrogen balance and the highest nitrogen retention was attained for goats offered diet R1followed by R2 and R3. The same trend was observed with daily gain (g/day). Feed efficiency (Kg/1 Kg gain) of diet R3 was higher than R1 and R2 (8.62 Vs. 8.75 and 8.94 Kg/1kg gain), respectively. Feed cost/ Kg B. W. gain were 4.33 2.99 and 2.47 L.E. for groups fed diets R1, R2 and R3, respectively.

The use of byproducts in goats diet could be recommended as non conventional diet since these feed ingredients may reduce feed cost.

Keywords: Organic wastes, desert, goats, growth.

INTRODUCTION

The lack of sufficient feeds to meet the nutritional requirements of existing animal population is one of the most critical problems of animal production in Egypt. The big feed gap between the requirements and the available sources necessitates great efforts to realize the best use of the available feed resources. Bedouins grow rainfed barley as well as olive and date- palm plantations. Sizable amounts organic wastes are produced annually, but some of these organic wastes are being used at small scale in animal feeding(Abd El Gawad, *et al*, 1994). Recovering by-products for use as animal feed can help food processors save money while preventing pollution. Generally, by products to be used as feedstuffs should be economical, dense in nutrients and free of toxins or other

substances that may be unhealthy for the animals. There is growing interest in the use of organic wastes, particularly agricultural wastes, agro- industrial byproduct and animal wastes, as low cost alternative feed sources for animals. Intensive efforts are being made in Egypt aimed at solving the problem of feed shortage through providing some alternative feed ingredients from such organic wastes. The potential contribution and utilization of agro-industrial by products and other organic wastes in animal feeding has been studied in Egypt (El Shaer *et al.*, 1996, Abdou, 1998 and Eid, 1998). The organic wastes can provide the basis for nutritious animal feeds if they are properly utilized.

The present study was carried out to investigate the possibility of using some organic wastes in feeding goats as non-conventional feedstuffs.

MATERIALS AND METHODS

The present study was conducted at Ras Suder Research Station, Desert Research Center, South Sinai and lasted for 105 days (feeding trail for 90 days followed by 15 days as digestibility trial). A completely randomized design was undertaken with eighteen growing Desert Black male goats (live body weight averaged 18.7± 0.21 Kg and aged 6-8 month old). Animals were randomly allocated to three groups (6 animals/pen) and were housed in separate pens for 90 days as a feeding trial, to determine the feeding value of the experimental supplements. All animal groups were given berseem hay to cover 50% of maintenance energy requirements (Kearl, 1982). Each group was offered one of the following three supplemental rations:

a- Concentrate feed mixture (CFM) which contained 35% undecorticated cotton seed cake, 33% bran, 22% yellow corn grain, 4% rice bran, 3% molasses, 2% limestone and 1.0% salt (R1).
b- Mixture of 35% ground date seeds + 27% olive pulp + 30% redycill + 8% molasses (R2).
c- Mixture of 35% ground date seeds + 27% olive pulp + 30% air-dried broiler litter + 8% molasses (R3).

Samples of the feed ingredient in supplements R1, R2 and R3 were analyzed for proximate chemical analysis.

All feed supplements were given to goats in R2 and R3 *ad libitum* whereas those in the control group were given commercial concentrate feed mixture (CFM) to cover the nutritional requirements of 100 g gain/ day (Kearl, 1982). Rations were offered to each group daily at 0800 and 1600 in separate troughs and voluntary feed intake from concentrates of each group was recorded. The drinking water was available all time. All animals were weighed at the beginning and then at biweekly intervals; body weight changes and daily gain were recorded for each animal. Immediately, at the end of the feeding period, three animals were randomly chosen from each group, and placed in individual metabolism cages for a 7-day preliminary period followed by a 7- day collection period followed by one day for rumen sample collection. The average voluntary intake during the last week of the feeding period was offered to animals during the digestibility trial. Intake of diets and excreta were recorded daily for each animal and representative samples of feed offered and refused and feces were collected, dried at 65°C for a constant weight and ground through 1 mm screen for proximate analysis (AOAC, 1984) and fiber constituents analysis (Goering and Van Soest, 1970). Urinary-N was determined by the standard micro Kjeldahl method. Rumen fluid samples were withdrawn 5 times daily at

0,3,6,9,12 hr .for the determination rumen ammonia nitrogen, (NH_3-N) total nitrogen (TN) and non-protein nitrogen (NPN) (AOAC, 1984). Ruminal volatile fatty acids (VFA) were measured as described by Warner (1964). Data were subjected to the statistical analysis using SAS, 1990. Differences among means were compared by Dancun' s multiple range test.

RESULTS AND DISCUSSION

Chemical composition of rations:

Results of the proximate chemical composition of feed ingredients are presented in Table 1.Generally, chemical constituents of the date seed, redycill, olive pulp and broiler litter were different. Broiler litter contained higher amount of CP (22.84%), ash (19.8%), NDF (69.3%) and ADF (48.3%) compared to date seed, redycill and olive pulp. Nutrients of date seeds, olive pulp, redycill and broiler litter are within the normal ranges and are consistent with those reported by El Shaer *et al.* (1994), Abdou, (1998) and Eid, (1998).

Results of the proximate chemical composition of rations (R1, R2 and R3) fed to the growing goats (Table 2) indicated that the R3 attained higher content of CF (25.24%), ash (12.7) EE (4.28), ADF(38.0) and ADL (8.11%) and lower content of NFE than for R1 and R2 due to olive pulp and broiler litter incorporation in concentrate mixture (27% and 30% respectively). In general all rations attained comparable amounts of crude protein (ranged 12.17 - 12.98). R2 and R3 contained the highest values of crude fiber (20.33 and 25.24%), ADF (34.75 and 38.0) and ADL contents (7.59 , 8.11) and lower content of NFE due to olive pulp incorporation in mixture rations (27%) which could affect feed utilization (El Shaer and Kandil, 1999).

The level of NDF in the tested rations should not limit the intake or cause insufficient feed utilization since the concentration of NDF less than 60% should not affect intake or digestibility of feeds (Van Soest, 1965). R1 (the control diet) contained higher levels of CP and NFE with lower content of CF, NDF, ADF and ADL. The range of NDF in the concentrates was 56.3 – 58.91 which would represent good quality diets.

Voluntary intake of rations and feed efficiency:

Data derived from the feeding trial (Table 3) revealed that both voluntary intake of rations and the type of rations influenced body weight changes of growing goats. The maximum intake of supplements (in terms of DM and CP) was recorded for goats fed R1 and R2 (20 .8 and 2.63 g/kg BW on average), while dry matter intake of supplement (R3) was 13.0 % lower than other supplements . These results indicate that broiler litter, as source of protein was less palatable than the other ingredients.

The maximum daily total dry matter intake (roughage and supplement) was recorded for goats fed R2 which contained redycill (38.8 g/kg BW), whereas, goats fed R3 revealed the lowest value (35.1g/kg BW). It seems that the addition of redycill to other ingredient of R2 enhanced the utilization of the agro-industrial byproducts (date seeds and olive pulp; Abdou, 1998. When total dry matter intake of different diets was expressed as percent of body weight, it ranged from 3.51 to 3.88 % for goats fed R3 and R2, respectively, and was within the mean values of 2.8 – 4.0% reported by Kearl, (1982) and Kandil *et al.* (1996) for growing male goats. The lowest dry matter intake recorded for goats fed R3 could be attributed to the higher proportions of Acid detergent fiber content (Phillips *et al.*, 1995 and Kandil, 1997). The crude protein intake of

Table 1. Chemical composition of ingredients (% on dry matter basis).

	CFM	GDS	OP	R. cill	BL	B Hay
Dry matter	90.7	88.1	84.6	87.6	86.4	83.0
Crude protein	12.98	9.61	9.02	21.63	22.84	11.70
Crude fiber	14.50	15.47	40.6	19.5	22.9	25.4
Ash	10.29	9.81	10.1	11.6	19.8	12.2
Ether extract	4.12	2.97	7.6	2.36	3.98	2.40
Nitrogen-free extract	58.11	62.14	32.68	44.91	30.48	48.30
Neutral detergent fiber	56.3	58.9	68.9	64.9	69.3	62.9
Acid detergent fiber	31.6	34.3	42.6	37.5	48.3	40.6
Acid detergent lignin	5.64	7.89	9.94	7.15	8.89	8.17

GDS: Ground Date seeds, OP: olive pulp. R. cill : Redy cill
B1 : Broiler litter. CFM : Concentrate feed mixture. B. Hay : Berseem hay.

Table 2. Chemical composition of the supplemental rations (% on DM basis).

Chemical composition	R1	R2	R3
Dry matter	90.74	90.71	92.41
Crude protein	12.98	12.28	12.17
Crude fiber	14.50	20.33	25.24
Ash	10.29	9.64	12.70
Ether extract	4.12	3.80	4.28
Nitrogen-free extract	58.11	44.06	39.78
Neutral detergent fiber	56.3	58.69	58.91
Acid detergent fiber	31.6	34.75	38.0
Acid detergent lignin	5.64	7.59	8.11

Table 3 . Intake and body weight changes of growing goats.

Items	R1	R2	R3	± SE
Live body weight /kg	19.0	18.7	18.5	0.16
Body weight changes:				
Kg	9.2	9.1	8.3	0.38
%	48.4	48.7	45.0	0.87
Daily gain, g/day	102.2	100.1	92.5	1.12
Intake,				
DMI g/kg BW				
Roughage	17.2	17.9	17.0	0.28
Supplement	20.7	20.9	18.1	0.54
Ratio	45.4:54.6	46.1: 53.9	48.4 : 51.6	-
CPI g / kg BW				
Roughage	2.01	2.09	1.99	0.03
Supplement	2.69	2.57	2.20	0.52
Feed efficiency ,				
kg DMI/1kg gain	8.75	8.94	8.62	0.43
Price of one 1 kg body gain /LE	4.33	2.99	2.47	0.15

supplements decreased with goats fed R3 (about 18%) compared to goats fed R2. This is mainly due to the lower dry matter intake of the supplement including BL.

The pattern of intake was reflected on body weight gain of goats (Table 3). The daily gains of growing goats fed R1 and R2 were higher by about 10.5 and 8.2%, respectively, in comparison with animals fed R3. The greatest body weight gain (expressed as percentage of initial weight or daily gain) were recorded for goats fed R1 and R2 which averaged 48.5% and 101 g, respectively. Daily growth rate of goats ranged from 92.5 to 102.2 gm which are comparable to those obtained for growing goats under similar feeding (El-Shaer, *et al.*, 1990). Feed conversion was calculated as DM consumed per Kg body weight gain as shown in Table 3.The feed conversion for goats fed R2 was about 1.02 and 1.04 times higher than that for R1 and R3, respectively. A similar trend was also observed by Abo El Nasr (1985) .According to 2000 prices , the cost of dry matter consumed to produce one kg body gain was in favor of the goats fed R3, and was lower by 17.4 and 42.9% compared to those fed R2 and R1 , respectively.

Nutritive value and nitrogen utilization:

Results in table 4 indicated that digestion coefficients varied significantly ($P<0.01$) among the three animal groups. Goats fed R3 tended to digest DM, CF and NFE less efficiently than those fed R1 and R2. Relatively low digestibility of crude fiber and crude protein in the R2 and R3 could be explained by their high contents of lignin (Table 2) as reported by several workers (El Shaer *et al.*, 1990 and Abou El Nasr *et al* , 1996). Redycill as the source of protein in R2 improved digestion coefficients of DM, EE, CF and NFE by 3.4, 4.6 , 1.6 and 2.2 unit respectively, compared to animals in R3. Both TDN and DCP intakes were also significantly ($P<0.01$) improved by goats fed R2. The highest TDN and DCP intakes were recorded for goats fed R1 followed by R2 and R3 due to better digestion and utilization of nutrients. All animals on the three rations were able to cover their maintenance requirements of energy and protein. Moreover, the TDN intake was exceeded by 67.0, 62.0 and 43.0% while, DCP intake was exceeded by 101, 84 and 68% for R1, R2 and R3 respectively, compared with recommendation of Kearl (1982) for growing goats in developing countries. Depression in TDN and DCP values of R3 may be due to the high lignin content (Table 2) and the fact that most of its total nitrogen is linked to lignocellulose (Aguilera, 1987).

Data on N intake, excretion and retention (Table 4) showed significant difference ($P<0.01$) among ration groups in favor of R1 and R2 groups. All animals were in positive nitrogen balance and retained various amounts of nitrogen. Goats in R1 group appeared to retain N approximately 12.0% and 58% higher than those in R2 and R3, respectively. The remarkable differences observed in N balance between R1 and R3 might be related primarily to differences in N intake among R1 and R3 groups. These results are in agreement with those recorded by Kwak *et al.* (1987).

Data in Table (5) showed that ruminal ammonia nitrogen were significantly ($P < 0.01$) lower in the both rations containing redycill (R2) and poultry litter (R3). The greatest value of ruminal ammonia (21.4) was recorded for goats fed the control diet (R1). This results are in agreement with those reported by Abdou (1998). However the values of ammonia nitrogen for goats fed the experimental diets ranged between 18.4 to 19.14 (R2 and R3 respectively). These values were similar to those reported by Khattab *et al.* (1999) who worked on agro-industrial by products fed

Table 4. Nutrient digestibilities and nitrogen utilization of goats fed different type of rations.

Items	R1	R2	R3	± SE
DMI, g / kg BW				
Roughage	15.7[a]	16.3[a]	16.5[a]	1.02
Supplement	18.8[a]	19.0[a]	17.1[b]	1.11
Total	34.5[a]	35.3[a]	33.6[a]	1.09
Digestion coeficients% :				
DM	63.0[a]	64.3[a]	60.9[b]	0.68
CP	61.2[a]	54.4[b]	56.4[b]	0.56
EE	58.2[c]	66.7[a]	62.1[b]	0.48
CF	60.1[a]	57.8[b]	56.2[b]	0.60
NFE	64.9[a]	60.3[a]	58.1[b]	1.22
NI mg/ kg BW	752[a]	746[a]	670[b]	7.63
Total nitrogen excreation	613[a]	632[a]	622[a]	5.87
Nitrogen retention mg/ kg BW	139[a]	114[a]	48[b]	1.73
DCP :				
g / kg BW	2.62[a]	2.39[a]	2.18[b]	0.04
% of MR	201	184	168	
TDN				
G/kg BW	20.0[a]	19.4[a]	17.1[b]	0.41
% of MR	167	162	143	-

MR : Maintenance requirements:

Table 5. Mean value of rumen metabolites for goats fed the experimental rations (as weighed means).

Items	R1	R2	R3	± SE
Ammonia nitrogen mg/100ml	21.4[a]	18.4[b]	19.14[b]	0.59
Total protein nitrogen mg/100ml	186.3[a]	168.2[b]	156.6c	4.55
Non protein nitrogen mg/100ml	104.6[b]	112.3[b]	123.7[a]	2.27
True protein mg/100ml	81.7a	55.8b	33.0[a]	4.25
Total volatile fatty acids m-equ.v./100ml	6.04[b]	6.80[a]	6.39[a]	0.26

to goats.

The lowest values(156.6) of total protein nitrogen (TPN) in the rumen liquor was recorded in R3 (30% poultry manure) than those in R1, R2 respectively. This observation was due to R3 being the lowest in nitrogen intake. The average ranged between (186.3 to 156.6) and was comparable with those reported by Khattab *et al.* (1999). The results indicated that R3 had the highest value of non protein nitrogen (NPN) in the rumen (123.7) mg/100 ml. However the lowest value was observed for R1 (104.6). The differences between treatments were significant ($P < 0.01$). These data were due to the incorporation of poultry litter or redycill in the rations. The values of NPN are in agreement witl those reported by Khattab *et al.* (1999).

However the opposite trend was observed with true protein. The higher value of TP (81.7) was for animals fed the control diets whereas the lowest (33.0), for goats fed ration containing poultry litter. The differences between treatments were significant ($P < 0.01$).

Values of TVFA were higher for animals fed R2 and R3 (30% redycill and 30% poultry litter) than those of R1. The values of ruminal TVFA were within the normal levels (6.04 –6.8m equiv/100 ml). These results were reported by El Sayed (1994), Eid (1998) and Abdou (1998). Also these findings may be attributed to the higher fermentation rate of the non-conventional diets (Salem *et al.*, 1989) in the rumen.

In conclusion, both byproduct diets (R2 and R3) were equivalent to the control and could substantially reduce feed costs. The effect of feeding such feedstuffs on nutrient utilization and animal performance particularly during pregnancy and lactation should be evaluated.

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إســتخدام بعــض المخلفــات العضــوية كمصادر غذائية للماعز النامية تحت ظروف الصحراء

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تــم تقييم نوعين من المخلفات العضوية من خلال تجربة تغذية استمرت ١٥٠ يوم على الماعز وأستخدم لهذه الــتجربة ١٨ ذكر من الماعز النامية بمتوسط وزن ١٨,٧ كجم قسمت لثلاث مجموعات بكل مجموعة ٦ حيوانات كانــت للتغذية على ٥٠% من الإحتياجات على دريس البرسيم لكل المجموعات وتكمل الإحتياجات على واحد من المركــزات التالــية ١- علف مصنع ، ٢- عليقة مركزة تتكون من ٣٥% نوى بلح ، ٢٧% تفلة زيتون ، ٨% مــولاس و ٣٠% رادى سيل ، ٣ - نفس تركيب المركز - ٢ - مع إستبدال الرادى سيل بفرشة الدواجن وكانت أهم النتائج كما يلى :

كانت كمية المأكول أعلى ما يمكن للعليقة -٢- .

معــاملات الهضــم كانت مرتفعة فى العلف المصنع (العليقة ١) عن العلايق المختبرة فيما عدا معامل هضم المــادة الجافة ومستخلص الأثير وكانت أيضاً القيم الغذائية مرتفعة فى العليقة رقم -١ بالنسبة لميزان الأزوت كان موجــباً فى العلايق الثلاث ولكن كان المحتجز داخل الجسم مرتفع فى العليقة - ١ تليه العليقة رقم -٢ ثم ٣ ونفس الإتجاه لوحظ مع معدلات النمو .

وكانــت الكفــاءة التحويلية للغذاء مرتفعة عند التغذية على العليقة رقم ٣ تليها العليقة ١ و ٢ أما تكلفة الغذاء لإنــتاج ١ كجــم نمو كان أعلى مايمكن مع العليقة الأولى ثم الثانية ثم الثالثة . مما سبق نستخلص أنه يمكن خفض تكاليف غذاء الماعز عند إستخدام بعض مخلفات التصنيع فى عمل علايق غير تقليدية .