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Research Article

Processed Animal Waste as a feed for Sudanese Desert Lamb

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Abstract

Recycling of animal wastes refers to making further use of the nutrients in the waste. Options available for recycling the nutrients in animal waste include: Sources of plant nutrients, Feed ingredients for farm animals, Substrate for methane generation and Substrate for microbial and protein synthesis. This study was conducted to evaluate inclusion of dried rumen content on performance of growing lamb diets. Graded levels of dried rumen content (0,10 and 20%) were incorporated in three diets iso-energetic, iso-nitrogenous diet for lambs. Diet A contained 0% dried rumen content while diets B and C contained 10 and 20% dried rumen content respectively. Thirty yearling male lambs of Sudan desert sheep ecotype Butana Ashgar with average body weight of 20 kg were used for the feeding trial. The lambs were randomly divided into three experimental groups having equal number and live weight. Each group was offered one of the experimental diets for a feeding period of 49 days. There was a significant ($P < 0.05$) linear increase in feed intake with increasing dried rumen content in the diet, resulting in significant effect on feed conversion efficiency, average daily gain and final body weight.It is thus concluded that dried rumen content when incorporated in lamb diets up to 20% supported a satisfactory live weight gain and feed conversion efficiency.

Introduction

Sudan has a large agricultural land with diversified climatic zones which creates a variety of animal resources and recognizes Sudan as one of the countries that promising agricultural potentials with largest population of livestock in Arab World and is second to Ethiopia in Africa. According to recent estimates of livestock there are about 88.963 million heads of animals (Ministry of Animal Resources, 2011).

Feed constitutes the largest single factor in the cost of production of animal of all kinds. Feeding practices and feeds in use today range from excessively costly to nutritionally inadequate and from highly efficient to wasteful materials. In order to achieve a successful feeding program, one should be able to provide proper nutrients at the lowest cost. The cost of feed, as percentage of total production costs, accounts for about 50- 60% of ruminant feeding systems and 65-80% in an industrial system (Khattak *et al* .,2009).Conventional animal feed in the Sudan include groundnut cake, groundnut hulls, sorghum grain and wheat bran. The relative abundance of these products and by-products offers antique opportunity for fast improvement of animal production in the country. Unfortunately, there are constraints facing their efficient utilization. These include export of these products, human nutrition, food industry and poultry nutrition. These facts necessitate seeking other potential feed stuffs that can replace conventional animal feed. These circumstances attracted the attention of nutritionists and farmers towards the use of non conventional by-Products in the livestock feed especially those originating from slaughter of large animals like rumen contents. The primary aim behind the use of these by-Products is to reduce the feed cost and consequently cost of producing a unit of the product like milk or meat as well as to fulfill the protein demands of animals (Haapapuro *et al.*, 1997).The dried rumen digesta obtained in this way not only serves as a feed nutrient, but also its recycling reduces disposal and environmental pollution problem (Swan, 1992).

The rising costs of waste removal are forcing the slaughter houses to rethink their present concepts for slaughter house by-Products management. Approximately 2.7 – 3.5 kg (DM basis) of ruminal contents are removed from cattle during slaughter (Prokop *etal*., 1974 and Dominguez *et al* . ,1994).

Previous studies have generally indicated that dry rumen contents contained substantial amounts of crude protein and utilizable energy for ruminants (Messersmith *et al.*, 1974; Prokop etal., 1974; Reddy and Reddy, 1980; El-yassin *et al*., 1991; Ghosh and Dey, 1993 and Salinas-chavira *et al*., 2007). In practice, the high moisture of the total rumen contents as collected at the slaughter house is still regarded as one of the obstacles that require an appropriate solution. Goodrich and Meiske (1969) used a forced air oven to dry rumen contents and found that beside its high economical costs, drying temperature had adversely affected the feeding value of the crude protein component. Sun drying is an excellent approach for tackling this problem (Abdelmawla, 1990 and Khattab *et al*., 1996).

The objective of this study is to evaluate level of inclusion of dried rumen content in diets for growing lambs on lamb performance.

Materials and Methods

Rumen content collection and treatment:

Rumen content of cattle were collected immediately after slaughtering in plastic bags from a local slaughter house at New Halfa and transported to Animal Production Department Farm then stored for a night at a low ambient temperature and dried by sun which during drying were turned daily for a week to accelerate complete drying then ground to allows easy mix with other ration ingredients. Representative samples of dried rumen content and experimental rations were taken for chemical analysis according to (AOAC, 1990).

Experimental animals and Experimental procedure:

The experiment was conducted at the Animal production department farm, Faculty of Agriculture and Natural Resources, University of Kassala,

Thirty lambs of Sudanese desert sheep (Al-Butana Ashgar) were purchased from New Halfa livestock market. Animals were selected according to age (6-8 months) and weight which was approximately 26 kg transported Animal Production Department Farm rested, ear tagged and given an adaptation period for two weeks.

After the adaptation period the animals were individually weighed and then randomly divided into three groups (A, B and C) of similar number and weight. The three groups were separately penned. Each pen was provided with watering and feeding facilities.

Adaptation period:

During this period animals were fed groundnut halum and a mixture containing equal percentage of the assigned experimental rations *ad libitum.* The groundnut halum was gradually substituted by rations mixture during the first 7 days. The rations mixture feeding continued till the end of the adaptation period.

Spraying with an acaricide solution against ecto parasites with Gematoxcine solution and deworming with Thiabenzole as a drench solution was performed and the Thiabenzole treatment was repeated after 15 days. Animals were also injected by antibiotic (oxy-Tetracyciline 20%) as preventive dose.

Feeds and feeding:

Three iso-caloric and iso- nitrogenous diets containing graded levels of dried rumen content (A 0%, B 10% and C 20%) were used. The other ingredients were sorghum grain, groundnut cake, wheat bran, groundnut hulls, molasses, salt and calcium carbonate. The chemical analysis, ingredient proportion and chemical analysis of dried rumen content and the experimental diets are given in tables (1) and (2).

During the feeding period, animals were fed daily the assigned diets *ad libitum*. The diets were offered in one meal at 7:00 am. throughout the study period which extended for 49 days. Green fodder (*Medicago sativa* and *Sorghum biocolor (L) Moench*) offered once a week at a rate of one kg/head/week to a void vitamin A deficiency. Clean water was available throughout the experiment period.

Data recorded:

Feed intake:

Total feed offered and residual for each pen were recorded daily to calculate group and individual feed intake by difference.

Live weight gain:

Animals were weighed weekly after fasting over night except from water to reduce the error due to variation in gut fill. The average weekly weight gain of each animals and feed conversion efficiency were calculated.

Feed conversion efficiency:

Feed conversion efficiency is determined by divided feed consumption over the weight gain in the same period as follows.

$$\text{Feed conversion efficiency} = \frac{\text{feed consumption (kg) (DM)}}{\text{Weight gain (kg)}}$$

Statistical analysis:

Data collected were subjected to analysis of variance (Steel and Torrie, 1990) of complete Randomized Design model while significant treatment means were separated by Duncan (Duncan, 1955) multiple range test.

Table 1. Chemical analysis (%) on DM basis of dried Rumen content

Dry matter (DM)	96.20
Crude protein	14.38
Crude fibre	24.80
Ether extract	4.40
Ash	16.42
NFE[1]	36.20
ME[2] (MJ/kg DM)	8.08

[1] NFE: Nitrogen free extract

[2] ME: Metabolizable Energy was calculated according to the equation:

ME (Mj/kg DM) = 0.012CP + 0.031EE + 0.005CF + 0.014NFE (MAFF, 1975).

Table2. Ingredients proportions and chemical composition of experimental diets.

Item	Treatment group		
	A (0%)	B (10%)	C (20%)
Ingredients (as fed)			
Dried rumen content	0	10	20
Sorghum grain	40	42	45
Wheat bran	9	6	5
Groundnut cake	21	19	16
Groundnut hulls	6	0	0
Molasses	22	21	12
Salt	1	1	1
Lime stone	1	1	1
ME (MJ/kg DM)	10.88	10.89	10.85
Crude Protein (%)	17.06	17.04	17.06
Chemical composition (DM %)			
DM	93.69	93.29	93.96
Crude protein	16.39	15.84	15.29
Crude fibre	18.62	20.75	26.76
Ether extract	3.91	3.79	3.85
Ash	8.57	8.87	12.85

Results

Feedlot performance:

Feedlot performance of lambs fed diets containing different proportions of dried rumen content (DRC) were shown in Table 3.

Live weight:

Average initial live weight was not significantly different among the treatment groups. The average final body weight was also not significantly different among the treatment groups. Group C (20% dried rumen content) had the highest final live weight (38.28kg); group B (10% dried rumen content) was intermediate (37.08kg) and group A (control) which had the least final body weight (34.94 kg).

Daily live weight gain:

Average daily live weight gain was not significantly different among the treatment groups. The average daily gain increased linearly as dried rumen content level increased in the diet. Group C showed the highest daily gain (209.06g), followed by group B (208.21g) and then group A (204.64g).

Dry matter intake:

Feed intake as give in Table 3 indicated that average daily feed intake differed significantly ($P < 0.05$) among dietary treatment groups. It increased as the level of dietary dried rumen content increased. Group C (20% DRC) consumed significantly ($P < 0.05$) more feed per day (1.32 kg), followed by group B (10% DRC) and group A (0% DRC) which had the least daily feed intake (1.06 kg).

Feed conversion efficiency:

Feed conversion efficiency (F.C.E) is also shown in Table 3. The feed conversion efficiency was not significantly different among the treatment groups. However, lambs fed diet C had better feed efficiency (7.16), followed by lambs on group B (7.46) and then group A which had the least F.C.E (7.58).

Table 3.Feed lot performance of lambs fed diets containing graded proportion of dried rumen content (DRC).

Item	Treatment groups				
	A (0%)	B (10%)	C (20%)	L.S	S.E
Number of animal	10	10	10	-	-
Feedlot period (days)	49	49	49	-	-
Initial body weight (kg)	26.10	25.90	26	N.S	0.61
Final body weight (kg)	34.94	37.08	38.28	N.S	1.12
Total live weight gain (kg)	8.84	11.18	12.28	N.S	1.09
Daily weight gain (g/head/day)	204.64	208.21	209.06	N.S	9.89
Total DMI (kg/head/day)	1.06[b]	1.18[b]	1.32[a]	*	0.03
FCE[1] (kg DMI/kg gain)	7.58	7.46	7.16	N.S	0.75

[1]Feed conversion efficiency
In this and subsequent tables:
L.S = level of significance
S.E = standard error of treatment means
N.S = not significantly different
* = significantly different at 0.05
** = significantly different at 0.01
*** = significantly different at 0.001
Means in the same line with the same superscripts are not significantly different.

Discussion

Chemical composition of dried rumen contents of bovine

Chemical composition of bovine dried rumen content in this study were 14.38%, 4.4%, 24.80% and 16.42% crude protein (CP), ether extract (E.E), crude fiber (C.F) and ash respectively. These values were similar in CP and EE values and higher in ash values than those reported by El-Yassin *et al*., (1991), Dominguez *et al*., (1994) and Rafaelli *et al*., (2006). However values obtained here were higher in CP and lower in EE and ash than that previously reported values given by Rios Rincon *et al*., (2010) and Fleming and McAlpine (2004). Our values were higher for CP and EE than that given by Sofer *et al*. (1975). The results of the present study showed that values for CP, CF and EE were higher but lower for ash content than the results obtained by Adeniji and Jimoth (2007). On the other hand values obtained here was similar in CP values but higher in EE and ash than those obtained by Abouheif *et al*., (1999). Chemical composition of dried rumen content (DRC) varies with diet type and period of fasting prior to slaughter (Cole and Hutchson, 1985 and Cole, 1991).

Feedlot performance
Feeding performance

All lambs remained in good health and no digestive disturbance or feed rejection were observed throughout the feeding trial. Similar results were reported by Tucker *et al*. (1956) who found that feeding dried rumen contents did not show any evidence of pathological effects in lambs. Also, Jovanovic and Cuperlovic (1977), Gabr (1992) and Khattab *et al*. (1996) clearly indicated that the inclusion of dried rumen content in the rations for ruminants produced no palatability problems.

Feed intake:

It is clear from performance data table (3) that feed intake tended to increase significantly ($P < 0.05$) with increase in dried rumen content. This might be due to increased crude fiber content and digestibility of the diet (Table 2). The improved final body weight and average daily gain of lambs fed on diet C 20% dried rumen content) over those fed on the other two diets B (10% dried rumen content) and A (control) might be explained by the increase in feed intake associated with diet C.

In addition to that diet C might have more microbial protein than the other diets due to its greater inclusion level of DRC. The increase in feed intake could be due to the increased proportion of fermented part of the diet. These findings were in line with Kattab *et al.*, (1996), Abouheif *et al*.(1999) and Abd El-Galil and Khider(2001). Contrary to the results obtained by Tucker *et al,.(*1956), Kamstra *et al*.(1959), Patra and Ghosh (1991), Ghosh and Dey (1993) and Bikash and Ghosh (1994) who reported that daily feed consumption in growing sheep or goats was not statistically different between the control group and those fed complete feed mixture containing rumen content in different ratios.

Body gain:

The overall live weight gain from an initial weight of about 26 kg to a slaughter weight of about 36.79 kg was not significantly different among the treatment groups. Similarly the average daily live weight gain was not significantly different among the treatment groups, but tended to increase with increasing level of dietary dried rumen content. The improved growth rate in this study was possibly due to increased dry matter intake. Khattab *et al*. (1996) found that daily body weight gain of lambs fed on 25 and 50% dried rumen content supplemented diets were higher than that in the control group. However, Abouheif *et al*.(1999) reported that average daily weight gain was higher ($P < 0.05$)in lamb fed control diet than for those fed dried rumen content with barely diets. El-Deek *et al*. (1984) showed that rabbits that were fed on diets containing dried rumen contents tended to gain weight slower than control animals.

Feed conversion efficiency (FCE):

In the present study Sudan desert lambs fed on different diets containing 0,10 and 20% dried rumen content ate 7.58, 7.46 and 7.16 kg of dry matter of feed to gain 1 kg of live weight respectively. These findings agreed with that of El-Khidir, (1989) for Sudan desert sheep fed on high energy diets, Beshir, (1996)for sheep fed graded levels of Karkadeh seeds, Suliman, (1999) for sheep fed different protein sources and Mohammed (2005) for sheep fed graded levels of Roselle seed.

The values for F.C.E reported here were inferior than the respective values (6.7 and 5.8) reported by Ahmed and Suliman (1988) for Sudan desert sheep (Shugor ecotypes) fed on two rations containing either cotton seed cake or blood meal, that of Gaili and Ali (1985) for Sudan desert sheep (5.9) and that reported by Suliman, (1976) (4.5) for Gezira weaned lambs. Ration composition differences as well as age and sheep ecotype differences might be the reasons for these wide differences.

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