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Effect of feeding urea-treated groundnut hulls (silage) and molasses during summer season on carcass characteristics of Desert lambs (Hammari subtype) under range condition

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[1]**Abstract**: The study was conducted at Elnuhood Desert Sheep Research Station, North Kurdofan State, Sudan, during late summer season; to evaluate the effect of supplementation of urea-treated groundnut hulls silage and molasses on slaughter weight and carcass characteristic of desert lamb Hammari ecotype. The duration of the experiment was 90 days, 60 lambs (thirty males + thirty females) of 6 months average age and 23.4 kg average live weight were divided into three equal groups(A,B, and C) of twenty lambs(10 males + 10 females) each. Groundnut hulls treated with 5 % urea (of its weight) was ensiled for 30 days. Animal in group (A) and (B) were offered a diet composed of 77% treated groundnut hulls and 23 % molasses, while Group C was un -supplemented (the control) . All the groups were left to graze in the same way practiced by the nomads in the area. Slaughter weights, carcass weights, composition yield and non carcass components were determined. Supplementation had higher values for slaughter weight, hot and cold carcass weight, empty body weight, gut fill weight, subcutaneous fat thickness, eye muscle area and dressing percentage but the differences were not significant (p>0.05) compared to the free grazing un supplemented group(C control). Subcutaneous fat thickness, dressing percentage, leg and loin cuts, total muscle , total fat and trims were not significantly different among the groups but the meat: bone ratio was significantly higher in group A (2.4). Group A had the heaviest cuts than group B and C. Non carcass components were not significantly (p>0.05) different among the groups except for empty rumen and reproductive organs. Wholesale cuts weights increased but not significant (P>0.05) with increasing the dietary supplementation. Body fat depots of the supplemented lambs especially group A was increased compared with the un-supplemented group which had thinner subcutaneous fat cover.

Key words: urea, groundnut hulls, silage, grazing, lamb carcass

المستخلص: أجريت هذه الدراسة فى محطة أبحاث الضأن الصحراوي بالنهود ، ولاية شمال كردفان السودان في اخر فصل الصيف لتقييم تأثير عليقة تكملية من سيلاج قشرة الفول السوداني المعالجة باليوريا والمولاس على وزن الذبيح وخصائص ذبيحة حملان الضأن الصحراوي النوع الحمري.فترة التجربة تسعون يوماً، قسمت ستون حملاً من الضأن الصحراوى (30 ذكور + 30 إناث) ، متوسط أعمارها 6 شهور ومتوسط أوزانها23.4 كيلو جرام، لثلاث مجموعات

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متساوية (أ، ب و ج) تتكون كل منها من 20 حمل (10ذكور+10 اناث).تم تخمير(سيلاج) قشر الفول السوداني المعامل باليوريا بنسبة 5% لمدة ثلاثين يوماً. الحملان قي المجموعات (أ) و (ب) غذيت بعليقة تحتوى 77% سيلاج و 23% مولاس. اما المجموعة (ج) – الشاهد – تركت ترعى حرة علي المراعي الطبيعة . تركت كل المجموعات ترعي بنفس الطريقة التي تمارسها القبائل الرعوية في المنطقة. تم تحديد الاوزان عند الذبح واوزان الذبيح وانتاجية التركيب والمكونات غير جسد الذبيح. أوضحت النتائج ان العليقة التكميلية اعطت قيم أعلى للوزن عندالذبح، وزن الذبيحة الساخنة والباردة ، ووزن الجسم الفارغ، ووزن محتويات الكرش ، وسماكة الدهون تحت الجلد، ومحيط العضلة العينية ونسبة التصافي ولكن كانت الفروق غير معنوية (P> 0.05)بالمقارنة مع مجموعة الشاهد التي تركت ترعى حرة بدون عليقة تكميلية (C). وكان سمك الدهون تحت الجلد و نسبة التصافي و قطعيات الفخذ والخاصرة ونسبة العضلات والعظام والدهون والتشذيبات الكلية لا تختلف معنويا (P> 0.05) بين المجموعات ولكن المجموعةِ A اظهرت نسبة اعلي معنويا(P< 0.05) من العضلات واقل من العظام (2.4) . المكونات غير الذبيحة لم تكن معنويا (P> 0.05) بين مختلف الجماعات التغذية عدا الكرش فارغة والأعضاء التناسلية.لم تظهر فروق معنوية (P> 0.05) في المكونات غير جسد الذبيح بين المجموعات عدا الكرش فارغة والأعضاء التناسلية . زادت اوزان القطع الاجمالية ولكن ليس معنويا(P> 0.05) مع زيادة المضافات الغذائية . كما ان مخازن الدهون في جسم الحملان التي اعطيت مضافات غذائية خاصة المجموعة A زادت مقارنة مع مجموعة الشاهد التي حققت أرق سمك في غطاء الدهون تحت الجلد.

Introduction

Sudan is characterized by vast areas of range which is either rain-fed or irrigated. This country has a large population of livestock estimated to be 29.4, 39.1, 30.5 and 4.6 million heads of cattle, sheep, goat and camel respectively where 60% of the estimated sheep figure is desert sheep which are well known of their high quality meat for local consumption and export (MARF, 2010). The specific problem regarding sheep nutrition under range land conditions is the climatic changes during the dry hot summer (February to June) causing feed shortage and nutrient deficiencies which were reflected in seasonality of reproduction, reduced conception, embryonic losses, reduced lambing rate, high mortality rate among both young and adult animals (EL Hag et al., 2001). To sustain and improve sheep production inexpensive, locally available feed resources that can enhance digestion of low quality feed resource and supply main nutrients to animal are possible alternatives for farmers. Management strategy which involves shorter watering intervals and feed supplementation resulted in increased live weights irrespective to sex of Hammari sheep under range conditions and significantly affect warm and cold carcass weights; empty body weights, dressing percentage and gut fill (Tibin *et al*., 2012). Molasses-urea block is an excellent supplementary feed that can be formulated and used to increase digestion of roughages, provide protein and energy to ruminants and enhance rumen microbial growth and voluntary feed intake of animals fed low quality roughages (FAO, 2007). Coupling fermentable nitrogen (urea) with a source of readily fermentable energy, such as molasses in molasses-urea block feed helps the growth of micro-organism in the rumen, increases the digestion and consumption of fibrous feeds, allowing the animal to maintain, and often increase productivity of ruminant animals (Bensalem and Nefzaoui, 2003). Feeding sorghum grain at rate of 48% to desert lambs Hammari ecotype produce a total lean of 49.15, total bone 17.29,total fat 27.80, total trim 3.39, and muscle to bone ratio 2.8 (Mohamed ,2003). Protein supplementation to ewes grazing low quality pastures improved their body weight, body condition score, reproductive performances, and ewes' body weight at lambing and fertility rate (Njoya *et al*., 2005). Supplementation is an efficient strategy to reduce nutritional stress in desert ewes and increase their productivity in the arid and semi-arid zones (Idris *et.al*, 2011). The objective of this study was to evaluate the effect of supplementation of urea-treated groundnut hulls silage and molasses on carcass characteristic of desert lamb (Hamari subtype) under range conditions.

Materials and Methods

Experimental animals and feeds: Sudanese desert lambs (Hammari subtype) thirty males and thirty females, of an average age (6 month) and live weight (23.4 kg) were used in the study. Lambs were selected from a herd owned by the Desert Sheep Research Station, Elnuhood. During the 15days adaptation period lambs were treated against external and internal parasites and provided with salt lick and vitamins thereafter lambs were divided randomly into three groups of twenty lambs (10 males+10 females) and ear-tagged according to the feeding treatments. The experimental diet was composed of 77% urea treated groundnut hulls silage and 23 % molasses (table 1), Group (A) was fed 400gm silage plus 120 gm molasses/animal and group(B) was fed 200gm silage plus 60 gm molasses/ animal and group(C) was left to graze the natural pasture (control). The experiment conducted in dry season from beginning of March to end of May 2010.

Table (1): Chemical compositions of the experimental diet

Feed ingredients	Proximate Chemical Composition				
	DM%	CP%	CF%	EE%	Ash%
Groundnut hull	95.1	5.45	61.1	1.23	12.37
Urea- treated groundnut hull silage	88.6	16.31	55.2	1.88	10.25
Molasses	74.4	3.1	-	-	-

At the end of the experiment, four lambs from each group were randomly selected and slaughtered, cut and dissected at meat laboratory, Department of Meat Production, Factuality of Animal Production, University of Khartoum.

Non-carcass components: The head was removed at the *atlnato-oxceptal* joint and weighed. After evisceration the digestive tract was weighed with and without contents and the gut fill was determined. The weight of gut fill was subtracted from the slaughter weight to obtain the empty body weight (EBW). Omentum fat, mesenteric fat and reproductive organs were removed and weighed individually. The kidneys and kidney knob channel fat (KKCF) were left intact in the carcass and removed after chilling at 4°c for 24 hours and weighed.

Carcass composition: Warm carcass, organs and offal were weighed immediately after dressing and recorded. Each carcass was labeled and chilled at 4°C for 24 hours to determine the cold carcass weight. The tail was removed at its articulation and weighed. Kidneys and kidney knob channel fat were removed and weighed. The carcass was split along the vertebral column into equal halves; the left half was weighed and split into whole sale cuts according to Smith et al. (1978). The subcutaneous fat thickness was measured at the 4th lumbar vertebrae by a Vernia caliper as described by Delfa et al. (1989). The outline of the cross-sectional area of Longissimus dorsi at the 12th rib was traced on a tracing paper; the area was calculated and recorded in square centimeters. Each cut was dissected into fat, muscle, bone and trim and each tissue was weighed.

Statistical analysis: Data were statistically analyzed as a complete randomize design using SPSS version 10.05-computer program. Treatment means were compared by Duncan's multiple range tests.

Results and discussion

Carcass characteristics

Carcass characteristics data are presented in table (2). Lambs slaughter weights, guts fill, empty body, hot and cold carcass weights were not significantly ($P > 0.05$) different among the experimental groups. Although the supplemented groups had the heaviest weights (group A followed by group B) compared with the control (C) which had the lightest weight. The dressing out percentage whether on slaughter weight or empty body weight bases was not significantly (P> 0.05) different among treatment groups (table 3). But the supplemented groups had a higher dressing out percentage. This result was in line with Tibin *et.a*l (2012) who found that the dressing percentage of desert lambs under range conditions increased significantly with supplementation. Subcutaneous fat thickness (mm) and eye muscle area (table2) increased but not significantly (P>0.05) with increasing supplementation, group A had the highest values (0.34mm, 9.20cm^2) while group C was the lowest (0.20mm, 8.00cm^2). The supplemented sheep especially group A had greater carcass fatness levels than the un-supplemented group which had thinner subcutaneous fat cover. This finding was in agreement with Field *et a*l., (1990) who reported that high plane of nitrogen in lambs diet result in heavier carcass and thicker fat depth compared with lambs fed low plane of nitrogen. Mohamed (2003) reported that, the average subcutaneous fat thickness in free grazing desert lambs was 0.33 cm. Díaz *et al* (2002) and Santos-Silva *et al* (2002) reported differences in lamb growth rate, carcass composition and carcass fatness levels due to feeding system. The eye muscle area increased with increasing the amount of supplement, the result was in line with Mohamed (2003) who used ground nut hay and hulls as supplement for desert sheep and found that average eye muscle areas were 17.0 cm^2 in pen fed and 8.59cm2 for free grazing desert lambs.

Table (2): Carcass characteristics of desert sheep lambs (hammari subtype) fed urea-treated groundnut hulls and molasses supplementation

Parameter	Supplemented groups			LS
	A	B	C	
Slaughter(kg)	26.25 ± 3.30	23.69 ± 2.15	22.25 ± 0.96	NS
Gut fill (kg)	6.65 ± 0.89	6.41 ± 1.36	5.98 ± 0.44	NS
Empty body (kg)	19.35 ± 3.04	17.28 ± 1.57	16.27 ± 0.94	NS
Hot carcass (kg)	10.93 ± 1.42	9.81 ± 1.14	9.15 ± 0.51	NS
Cold carcass (kg)	10.23 ± 1.59	9.19 ± 1.07	8.38 ± 0.48	NS
Dressing %	41.68 ± 1.03	41.37 ± 1.03	41.04 ± 1.03	NS
Half carcass (kg)	5.13 ± 0.85	4.69 ± 0.63	4.25 ± 0.20	NS
Eye muscle area(cm^2)	9.2 ± 3.6	8.9 ± 0.7	8.0 ± 15	NS
Subcutaneous fat thickness (mm)	0.34 ± 0.09	0.28 ± 0.05	0.20 ± 0.06	NS

Non carcass components

As shown in table (3), there were significant (P<0.05) differences in empty rumen and reproductive organs weights among the feeding groups where lambs in group (A) had the highest weights. The other non-carcass components weights were not significantly (p>0.05) different among dietary treatments groups although increasing dietary supplementation resulted in an increase of the absolute weights of the intestine empty, head, tail, KKCF., mesenteric and omentum fat and reproductive organs. Tibin *et.al* (2012) reported that the weight of reproductive organs of desert lambs hammari subtype under range conditions significantly affected by supplementation. The high gut fill and the significantly heavy weight of empty rumen and a non significantly heavy weight of the intestine of the supplemented groups could be attributed to the amount of feed consumed by the animal which was expressed in heavy carcass weights and fat depositions. The lower fat deposition in the un-supplemented groups C could be due to the shortage and low nutritional value of the pasture during summer season and on the other hand due to the physical activity while searching for feed. These finding was in line with Mohamed (2003) who found gut fill weight was heavier in pen fed lambs and lower in free grazing lambs. The results were in harmony with Cloete *et al* (2012) levels of fat deposition in free range lambs could be due to changes in the metabolism caused by physical activity during foraging. Diaz et al (2002) observed a higher subcutaneous fat cover in feed lot lambs compared to those raised under free range conditions. Reduced carcass subcutaneous fat was observed in lambs that had grazed on pastures compared to lambs fed on concentrate (Diaz *et al*., 2002; Joy *et al*., 2008b). However when the diet of grazing lambs is supplemented with concentrate their fatness degree is similar to that observed in indoor lambs (Carrasco *et al*., 2009)

Table (3): Effect of feeding urea treated groundnut hulls and molasses on non carcass component weights (kg) of Hammari desert lambs

Trait	Supplemented groups			LS
	A	B	C	
Rumen empty	0.96±0.08[a]	0.82±0.09[ab]	0.76±0.03[b]	*
Intestine empty	0.72±0.72	0.71±0.71	0.62±0.62	NS
Tail	0.21±0.03	0.18±0.04	0.15±0.06	NS
Head	1.82±0.18	1.70±0.18	1.59±0.06	NS
Reproductive organs	0.19±0.12[a]	0.15±0.07[ab]	0.14±0.09 [b]	*
KKCF*	0.18±0.06	0.15±0.047	0.15±0.09	NS
Mesenteric fat	0.18±0.04	0.15±0.06	0.12±0.04	NS
Omentum fat	0.16±0.11	0.14±0.08	0.13±0.07	NS

* Kidney knob channel fat, * P<0.05

Carcass yield and tissue composition

As seen in table (4) wholesale cuts weights were not significantly different among feeding groups but animals in group A had the heaviest cuts than the other two groups. Lambs wholesale cuts weights increased but not significantly (P>0.05) with increasing the dietary supplementation. This increase was prominent in the primal cuts mainly leg, shoulder, loin and sirloin thus the carcass weight affects the cuts weights.

Table (4): Effect of feeding urea-treated groundnut hulls and molasses on wholesale cuts weights (gm) of Hammri desert sheep lambs

parameters	Supplemented groups cuts weights(gm)			LS
	A	B	C	
Rack	423.0± 83.4	410.5± 48.5	389.0± 53.7	NS
Loin	363.5± 47.8	327.7± 31.1	284. 80± 53	NS
Flank	185.0± 138.0	125.8± 31.6	121.0± 14.3	NS
Shoulder	750.3± 178.6	715.1± 99.1	640.6± 46.5	NS
Neck	441.6± 79.4	398.8± 45.9	348.0± 32.3	NS
Leg	1333.3± 243.8	1134.9± 130.6	1061.8± 51.9	NS
Fore shank	609.3± 98.7	527.4± 25.7	520.8± 93.8	NS
Breast	361.6± 37.7	310.9± 54.0	296.3± 39.6	NS
Sirloin	349.9± 45.5	330.0± 46.4	297.9± 47.5	NS

Total muscle, bone, fat and trim as percentage of cold carcass weight data revealed no significant differences among feeding groups although animals in group A had got the highest muscles% and lowest fat and bone percentages. Total carcass muscle % increased and total bone % decreased but not significantly (P> 0.05) with increasing the supplemented diet (table 5), group A, B, and C gave 53.14%, 52.62% and 52.25% for muscle% and23.01%, 23.2% and 24.66%

of total bones respectively. Differences in total carcass fat % were not significantly (P> 0.05) different among treatments groups. Muscle: bone ratio was significantly (p<0.05) different among treatments, group A recorded the greatest value (2.4) than groups B (2.2) and C (2.2). Tibin *et al* (2012) stated that the total carcass tissues of Hammari sheep supplemented with concentrates were greater than those grazed on natural pasture. Grazing lambs had less developed fat depots probably due to the limited energy intake that may provide enough energy for bone and muscle tissue development but not for fat accretion. The feeding system had a clear effect on the total fat percentage, although the magnitude of the effect varies according to fat depots (Carrasco *et al* 2009)

Table (5): Total carcass tissues (%) and meat: bone ratio of Hammri desert lambs supplemented with urea-treated groundnut hulls and molasses

Parameters (%)	Supplemented groups			LS
	A	B	C	
Total muscle	53.1± 0.78	52.62± 0.62	52.25± 0.7	NS
Total bone	23.01±0.19	23.2.0± 0.31	24.66± 0.14	NS
Total fat	0.08± 0.22	0.07±0.18	0.07± 0.35	NS
Total trim	0.06. ± 0.13	0.05± 0.03	0.06± 0.13	NS
Meat: bone ratio	2.4±0.06[a]	2.2±0.06[b]	2.12±0.06[b]	*

Conclusion

The study indicated that lambs fed urea-treated groundnut hulls (silage) and molasses during summer season generally had heavier final body weight, carcass weight and meat: bone ratio than free grazed ones. Supplementation of urea-treated groundnut hull (silage) and molasses to grazing desert lambs is efficient for maintenance and production purposes.

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