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The Utilization of Rumen Contents-Sorghum Stover Silage in Diets for Ruminant (Physical, Chemical and Ruminal Degradation Characteristics)

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Abstract
The current study was conducted to evaluate the proximate composition and rumen degradation characteristics of rumen contents ensiled with sorghum stover. Fresh rumen content (RC) was collected from slaughtered cattle of Animal Production Research Centre (APRC), abattoir and then ensiled with sorghum stover (SS). Two silages were prepared as 50%, 30% and 20% (50% RC) and 60%, 30% and 10% (60% RC) for fresh RC, SS and molasses-urea mix respectively. The results revealed that ensilaging improves the nutritive value of SS through increasing crude protein (CP) contents and decreasing crude fibre (CF) contents. Furthermore ensilage produced better dry matter (DM) degradation characteristics than the degradation of individual RC and SS.
Keywords: Slaughter house wastes, Degradation, Ruminant feed

Introduction
The use of animal wastes as animal feed are of ethical and aesthetic concern beside potential risks related to wastes accumulation. Mostly matters in those animal wastes are the excessive accumulation of macro-minerals, trace elements, heavy metals, drugs, insecticides, herbicides, mycotoxins and hormones, and also in the presence of harmful organisms transmittable via wastes to animals and man. These problems, however, do not relate to wastes alone: conventional feeds may contain a large number of contaminants in the form of phytotoxins, pesticides, pathogens and other xenobiotics (Müller, 1980).

One of the most commonly used animal wastes as animal feed is the rumen contents. Rumen contents is available in large amounts as slaughterhouse by-products, however they cause naissance and actual environmental pollution. The use of rumen contents as animal feed is not recent and mainly due to moderate protein contents beside the presence of parts of indigestible fibre. The main problem arising from using it as livestock feed, is the high moisture contents make it more susceptible to fermentation and production of unpleasant odours that may affect its

palatability. One of the arising solutions is drying using power. This solution became less popular in developing countries due to the high cost. Another proposal is by mixing it with other feeds of lower moisture contents or ensilage. Rumen contents either dried or moist were used as ruminant (Abouheif *et al*., 1999) or even poultry (Colette *et al*., 2013) feed resource for protein and fibre. The objectives of this study are to evaluate the nutritive value of rumen contents as ruminant feed when ensiled with sorghum stover, decreasing environmental pollution through recycling rumen contents and finally to make better use of sorghum stover as a fibre source for ruminants.

Materials and Methods

All experiments were done in the experimental farm of Small Ruminant Department, Animal Production Research Centre- Kuku, Khartoum North, Sudan during the period from March to September 2010 which corresponds to hot dry season up to early rainy season in Sudan.

Experimental procedure: secondary data was collected from the slaughter house of Animal Production Research Centre for years 2003, 2004, 2005 and 2007.that data included the number of slaughtered bulls, initial weight, final weight and weight of rumen-contents on fresh basis.

Rumen-content: Rumen-content was obtained from the slaughter house of the Research Centre immediately after slaughtering in plastic barrel. Three samples were collected from fresh rumen-contents for three days; then temperature, pH and dry matter (DM) contents were recorded. Samples intended for analysis were dried to a constant weight in a forced air drying oven for 24 hours, ground to become ready for chemical analysis.

Sorghum stover: samples of sorghum stover were taken from the farm of the Centre. Sorghum stover referred to as agricultural by-product that left in field after harvesting sorghum grain's cob. The stover is highly fibrous material consisting of stems and dry leaves were chopped to 5 cm length and bundled into 10 kg packs usually used as a main roughage source in feeding cattle in Sudan.

Ensiling rumen-contents-sorghum stover: two silages were prepared from rumen-contents and sorghum stover silage; each comprised either 50% or 60% rumen contents (RC) and sorghum stover, either 20% or 30% molasses-urea mix repectively for 50% RC and 60% RC.

Molasses-urea mix: molasses-urea mix was prepared by dissolving urea in molasses at 4% (weight/weight) then diluted with tap water at the ratio of 1:1.

All silages were replicated four times and after proper mixing of ingredients, they were filled into plastic sacks, pressed to expel air and buried for at least four weeks.

Experimental animals: two rumen fistulated Baggara type bulls (250-300 kg body weight) were used and were fed a balanced diet for maintenance.

Degradation characteristics of rumen contents and sorghum stover and their silages in the rumen of fistulated bulls: degradation of tested samples was measured through weighing 2g (three replicates) into nylon bag and incubation in the rumen of the two fistulated bulls fed on maintenance balanced diet. The incubation period continued for 96 hours, and then the bags were removed at 8, 24, 48, 72 and 96 hours, washed under running tap water, dried in dry

oven (temperature 60-65) over night and weighed to determine dry matter degradation (DMD) as described by Ørskov and McDonald (1979). The dry matter loss or degradation percentage was calculated as follows:

Dry matter loss % = weight of sample g- weight of residue after incubation g X 100
Weight of sample g

Physical assessment of silages: physical analysis was done to silages immediately after opening silage bags including colour and smell. Data collected was done through questionnaire filled by untrained people (5 people). The questionnaire was containing the following attributes:

Colour		Aroma	
Number	Attribute	Number	Attribute
1	Black or dark brown with fungal infection	1	Rancid butter, sour or putrid aroma
2	Light brown	2	Fruity alcoholic smell
3	Light green to green/brown	3	Sour milk, natural yogurt smell

Chemical analysis: all samples under study were subjected to chemical analysis including dry matter (DM), crude protein (CP), ether extract (EE) and fibre (ADF) according to AOAC methods (1990). pH of silages was measured using Hanna pH meter.

Results and Discussion

Fresh rumen contents, which were collected from 204 bulls, during 4 years periods (Table 1); these amounted to 6236 kg. The contents represented 10.4% of bull body live weight (BW), 42.8 % of metabolic weight ($w^{0.75}$), and 11.5% of empty body weight (EBW). Disposal of such large amounts of rumen waste may create real environmental hazards; however, rumen contents, can better be used in ruminant feeding.

Table 1: Rumen contents (kg- fresh basis) at the slaughter house of Animal Production Research Centre in the years 2003, 2004, 2005 and 2007

Parameter	Year				General mean ± SD
	2003	2004	2005	2007	
No. of animals	60	35	42	67	N= 204
Average bull weight (kg)	298.8	287.6	301.2	295.4	295.2± 5.91
Fresh rumen contents (RC), kg/bull	30.1	31.8	29.7	30.6	30.6± 0.91
RC % BW	10.2	11.1	9.8	10.3	10.4 ± 0.545
Metabolic body weight Kg ($W^{0.75}$)	71.86	69.83	72.30	71.23	71.31± 1.01
RC g/kg $W^{0.75}$	424.4	455.4	408.0	424.5	431± 42.80
Empty body weight (EBW), kg	268.2	255.8	271.6	264.9	265.2± 6.79
RC % EBW	11.31	12.43	10.86	11.51	11.5± 0.654

Rumen contents were reasonably estimated from metabolic body weight by the relationship.

$RC = 6.408 + 0.3291x\ (W^{0.75})$; $R^2 = 0.392$, RSEM= 3.739, N=29; [P < 0.0002].

The physical assessment and pH of rumen contents-sorghum stover silages are shown in Table 2. The colour recoded a value of 1.5 value indicating

brownish of both silages which is not uncommon for sorghum stover and molasses. Aroma recorded 2.25-2.5 which approaches good quality silage. Furthermore, pH values (3.96-3.99) were within the normal range for good quality silage as indicated by Mc Donald *et al*.,(2002), showing pH values less than 4- 4.5 for ensiled feed stuffs.

Table 2: Physical assessment and pH of rumen contents-sorghum stover silages

Parameter	rumen contents-sorghum stover silages	
	50%RC	60%RC
Colour	1.5	1.5
Aroma	2.5	2.25
pH	3.99	3.96

Chemical composition of rumen contents saliges were shown in Table 3. The low dry matter of rumen contents obtained in this study (22.91%) lied within the normal range recorded by Rezakhani *et al*., (2008) of 19.61-20.56 %. The same is true for crude protein and ADF (9.97-11.83) and (41.98-44.69 %) respectively. Curde protein contents of sorghum stover-rumen contents silages obtained values (4.46-5.3%) were lower than other values reported by Ferdowsi *et al*., (2012), of 7.14-9.59% for ensilage of rumen contents with wheat straw and molasses. That could attributed to the fact that rumen contents had the highest crude protein compared with other ingredients in the silage, in which rumen contents represented almost 80% of the total diet, Ferdowsi *et al*.. (2012). Thus the higher proportion of rumen contents in the silage mix, the higher CP% will be in the mix.

Table 3: Chemical analysis (%) of rumen contents and sorghum stover and their silages

Analysis	Sorghum stover	Rumen contents (RC)	50%RC	60%RC
DM	94.6	22.91	42.66	46.83
Ash	9.09	8.63	11.29	10.96
Organic matter (OM)	90.91	91.37	88.71	89.04
CP	1.88	11.88	4.46	5.3
ADF	37.5	39.0	27.5	30.5
EE	1.0	1.6	2.1	1.7

Degradation characteristics are shown in table 4. It indicates that rumen contents had the lowest soluble fraction (a); which is less than in stover; as expected, because rumen contents (RC), had already been fermented to some degree, where in a large portion of soluble fermented fraction (a), would be absorbed in the rumen, on exposure to rumen environment, presumptively as ingested feeding material. Therefore, rumen contents can be considered as fermented starter culture, when mixed with stover and anaerobicaly incubated. Similar conclusion was drawn by Hassan *et al*., (2011) ensiling wheat straw with cattle manure and El-Yassin *et al*., (1991) ensiling rumen contents with wheat straw. In fact, rumen content entities, containing mixtures had higher degradabilities (44.5%, 63% and 63.5%), then stover degradability (31.3);

although stover had the highest degradation rate (c), than the other rumen contents containing mixture.

Table 4: Degradation characteristics of rumen contents and sorghum stover and their silages in the rumen of two fistulated bulls

Incubation time (hours)	Dry matter loss (%)			
	Sorghum stover	Rumen contents (RC)	50%RC	60%RC
8	28.8	16	44.3	39
24	40.9	27	45.3	41.3
48	53.3	33.8	56.3	52.5
72	50.3	42	63.6	65
96	62	46.5	59.6	60.5
Degradation parameters				
a	21.5	11.3	38.5	32.5
b	40.6	44.9	28.2	41.1
c	0.026	0.015	0.019	0.015
a + b	56.2	62.2	66.8	73.7
Pe (k=0.02)	31.3	44.5	63.0	63.5
Pe (k=0.05)	22.2	35.4	62.7	62.7
Pe (k=0.08)	18.8	31.5	62.7	62.7

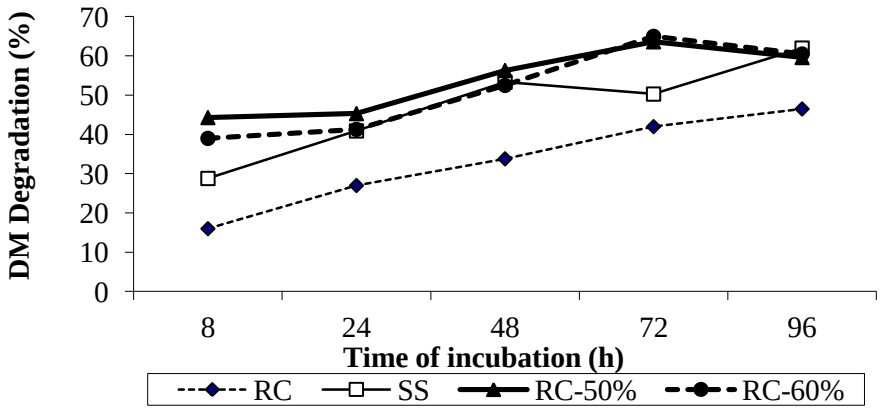

Figure 1: Dry matter degradability of sorghum stover (SS), rumen contents (RC) and their different combinations in the rumen of fistulated bulls

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Conclusion and Recommendations
The rumen contents could possibly be used as a feed for ruminants. Ensiling sorghum stover with rumen contents increases the nutritive value of both components. Further studies are required

to test intake and digestibility of those feeds by ruminants and expected probable effects on production performance.

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استخدام سيلاج لمحتوى الكرش– سيقان الذرة في علائق المجترات
(الخصائص الفزيائية و الكيمائية و الهضم في كرش المجرات)

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المستخلص

هذه الدراسة تم اجراءها بهدف تقييم المكونات الغذائية الأولية و خصائص الهضم لمحتوى الكرش مع سيقان الذرة. المحتوى الكرش الخام تم جمعه من المذبح التابع لمركز بحوث الانتاج الحيواني– كوكو ثم تمت سولجته مع سيقان الذرة. حيث تم تحضير نوعين من السيلاج تحتوي على 50%، 30% و 20% (50% محتوى كرش) و 60%، 30% و 10% (60% محتوى كرش) لمكونات محتوى الكرش، سيقان الذرة و مخلوط المولاس و اليوريا بالتتابع. أوضحت نتائج الدراسة ان السولجة قد حسنت القيمة الغذائية لسيقان الذرة و يتمثل ذلك في ارتفاع مستوى البروتين الخام و تقليل نسبة الالياف الخام. كما أن السولجة انتجت منتج تفوق على المكونات الفردية؛ من محتوى الكرش و سيقان الذرة؛ من ناحية درجة التكسر و الهضم.