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FEEDLOT PERFORMANCE AND CARCASS CHARACTERISTICS OF SUDAN BAGGARA BULLS FED VARYING LEVELS OF PELLETED SORGHUM STRAW

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ABSTRACT: Thirty six entire Sudan Baggara bulls of an average weight 201.53±6.85 kg and 2.5 year age were divided into four groups of nine animals each. These bulls were fed varying levels of pelleted sorghum straw (roughage portion) with a concentrate molasses based mash diet to examine the effect of nutrition on their feedlot performance and carcass characteristics. Results showed that, feeding of varying levels sorghum straw did not affect dry matter intake (DMI), average daily gain (ADG) and feed conversion ratio (FCR). Carcass characteristics and meat quality attributes were not affected by the treatments, but showed variable results.

ORIGINAL ARTICLE

Key words: *Bulls, Pelleting, Molasses, Feedlot, Carcass Characteristics*

INTRODUCTION

Sorghum straw is an agricultural by-product remaining after harvesting the cereal crop. It is an aerial part of sorghum plant that, either left in the field to be ploughed later in the soil or being grazed by animals. In Sudan sorghum straw were harvested two weeks after grain harvest and may be subjected to further processing like chopping or pelleting to be fed to animals. Abdlrahman et al. (1981) reported that Sudan produces about 64% of all the amount of sorghums straw in the Arab world, but its use as an animal feed is abundant in spite of the high transportation costs. Chemically sorghum straw is primarily composed of cellulose, hemicellulose and lignin in addition to protein, sugar and ash (Elkhidir et al., 1984). The objectives of this study were to examine the effect of pelleting sorghum straw at varying levels on feedlot performance, carcass characteristics and meat quality of Sudan Baggara bulls.

Materials and Methods

This experiment was conducted at the Animal Production Research Centre, KuKu (APRC), Khartoum North during (July – October 2006). Thirty six entire Sudan Baggara bulls of 2.5 year old and with an average body weight of 201.53±6.85 kg were used in this experiment. The bulls belong to the commercial herd of (APRC) purchased from the local market of Omdurman (Elmoelih). They were trekked to the site of experiment and accommodated into four feeding groups of nine animals each, further subdivided into three subgroups of three animals each in shaded pens (4 x 3 m). An adaptation period of three weeks was allowed to the animal prior to commencement of the feeding trial. The four feeding systems were offered molasses based-diet mash + 10, 20, 30 and 40% pelleted sorghum straw roughage, for group A, B, C and D, respectively. The molasses based diet was composed of 50% molasses, 39% wheat bran, 5% groundnut cakes, 3% urea, 1% and common salt. Sorghum straw pellets offered separately as a roughage portion at first then followed by the molasses-based diet at 7:00 am daily. The molasses and urea were incorporated as major source of energy and nitrogen, respectively. The total metabolizable energy (ME) for the molasses diet and sorghum straw pellets was 11.1 and 6.7 MJ/kg DM, respectively as shown in Table (1). The experiment continued for 60 days during which measurement of dry matter intake (DMI), average daily gain (ADG), feed conversion ratio (FCR) were recorded. The bulls were slaughtered at a finishing live weight of 260 kg,

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while the carcass cuts was performed following the MLC (1974) method for beef carcass. Chemical composition of the meat was done as described by AOAC (1975) method. Meat quality attributes, water holding capacity (WHC), cooking loss determination, objective measurement of tenderness and sensory evaluation were performed and calculated.

Statistical analysis

Data was statistically analyzed by Stat soft, Inc (1995) for windows (computer program manual). Least squares means were calculated and significance was declared at ($P<0.05$).

Table 1 - Chemical composition of the experimental diet

Component (%)	Molasses concentrate Mash	Sorghum straw Pellets
Dry matter (DM)	88.4	95.6
Ash	6.2	7.88
Crude protein (CP)	19.6	5.81
Ether extract (EE)	2.12	2.15
Nitrogen free extract (NFE)	56.2	40.8
Metabolizable energy (MJ/kgDM)	11.1	6.7

RESULTS

The experimental diets indicated no differences in feedlot performance of Sudan Baggara bulls in average daily gain (ADG), total live weight gain, dry matter intake (DMI) and the feed conversion ratio (FCR) as shown in Table (2).

Results of the carcass yield and whole sale cuts of the slaughtered bulls were not affected by the dietary treatments as shown in Table (3). Similar results obtained from non-carcass components of the slaughtered bulls, although group A showed high mean values in all parameters investigated compared to other groups and the differences was not statistically significant ($P>0.05$, Table 4).

Carcass yield and characteristics of Sudan Baggara bulls are shown in Table (5). High slaughter weight observed in group D, while group A showed high values of empty body weight, hot and cold carcass weight as well as dressing percentage and shrinkage percent. No significant differences were found among the experimental groups.

Table 2 - Feedlot performance of Sudan Baggara bulls fed varying level of sorghum straw pellets

Parameters (kg)	Means ± SD			
	A	B	C	D
No. of animals	9	9	9	9
Period (days)	60	60	60	60
Initial live wt (kg)	201±5.65	199±5.46	202±9.05	202±7.12
Final wt (kg)	259±1.67	266±2.50	259±3.63	262±2.50
ADG (kg)	0.96±0.13	1.02±0.17	0.84±0.16	0.91±0.14
Total gain (kg)	56.7±5.00	61.1±4.86	55.6±8.46	59.5±0.08
Total DMI kg/head/day	658±66.3	654.5±7.2	55.6±8.46	59.4±8.08
DMI kg/head/day	9.97±1.63	9.75±1.62	9.74±1.75	9.70±0.90
FCR kg/feed/kg gain	10.4±0.92	9.6 ±0.75	11.7±2.06	10.6±1.65

In this and subsequent tables: A, B, C and D are four rations of molasses based-diet mash (10, 20, 30 and 40 %) pelleted sorghum respectively. SD= Standard Deviation.

Table 3 - Carcass yield of the whole sale cuts of the slaughtered bulls (percent of cold side weight)

Parameters (kg)	Means±SD			
	A	B	C	D
Skin	2.13±0.1	2.08±0.2	2.10±0.1	2.15±0.2
Neck	3.68±0.4	3.65±0.6	3.49±0.6	3.25±0.3
Chuck	6.84±1.0	7.09±1.0	7.30±0.4	7.08±0.7
Clod	4.18±0.6	4.01±0.4	4.13±0.5	7.08±0.7
Ext. roasting ribs	4.09±0.6	4.18±0.6	4.61±0.6	4.37±0.7
Thick ribs	3.54±0.6	3.62±0.5	3.42±0.5	4.56±0.5
Thin ribs	2.06±0.3	1.93±0.3	1.99±0.2	2.01±0.2
Brisket	5.41±0.5	5.35±0.6	5.63±0.6	5.54±0.3
Thin flank	3.95±0.4	4.25±0.2	3.88±0.1	39.3±0.4
Thick flank	3.95±0.4	4.25±0.2	3.88±0.3	2.97±0.3
Sirloin	4.13±0.5	3.98±0.4	4.22±0.3	4.14±0.4
Tope & silver side	11.2±0.4	11.1±0.7	11.2±0.4	11.7±0.5

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Table 4 - Non carcass components of the slaughtered bulls fed varying sorghum straw levels (percent of empty body weight EBW)

Parameters (kg)	Means ± SD			
	A	B	C	D
Hide wt	20.5±1.9	20.4±2.3	20.3±1.4	19.3±2.6
Head wt	15.7±0.6	15.8±0.3	15.1±0.6	15.6±1.2
Four feet wt	5.99±0.5	5.85±0.3	5.97±0.4	6.08 ±0.5
Stomach wt (full)	29.7±3.7	30.2±5.6	31.8±3.8	33.7±6.1
Stomach wt (empty)	7.71±1.2	7.63±0.7	7.51±0.9	7.17±0.9
Intestine wt	15.4±1.9	14.2±1.7	15.6±2.3	15.2±2.6
Mesenteric fat	1.16±0.3	0.92±0.2	0.23±2.2	0.22±2.3
Omental fat	3.19±0.8	3.03±0.4	2.22±0.6	2.32±0.5
Kidney fat	2.37±0.7	2.44±0.5	2.22±0.5	2.30±0.5
Kidney wt	0.66±1.6	0.67±0.1	0.64±0.1	0.68±0.1
Liver wt	4.38±0.6	4.20±0.6	3.97±0.4	4.11±0.4
Heart wt	0.92±0.1	0.86±0.1	0.84±0.1	0.91±0.1

Table 5 - Carcass yield and characteristics of Sudan Baggara bulls

Item	Mean ± SD			
	A	B	C	D
Slaughter wt (kg)	259.4±1.67	206±2.5	257.8±3.63	261.7±2.5
Empty body wt (kg)	230.1	231	225.9	227.8
Hot carcass wt (kg)	138.9±5.26	136.9±6.34	135.3±3.69	136.8±3.11
Cold carcass wt (kg)	134.7±5.1	133.3±6.6	132±3.9	133.7±3.3
Hot carcass dressing (%)	53	52	52	52
Cold carcass dressing (%)	51	51	51	51
Shrinkage %	3.32±0.5	2.96±0.4	2.66±0.6	2.6±0.9

Bulls in group B appeared to contain more fat (6.93) than others but no difference were observed (P>0.05). The percentage of meat, bone and connective tissue did not affected by the treatment and appeared to be similar (Table (6). The study found high values of water holding capacity (WHC) in group C and lower in group D which received high amount of sorghum straw. However, cooking loss was higher in group C and D. No significant differences were observed between groups (P>0.05, Table 7). Juiciness and tenderness of meat were higher in group A (6.79, 6.99) and B (6.40, 6.74), respectively than in groups C (4.18, 4.40) and D (3.43, 3.76). The same pattern was found in the panelist score for overall acceptability (Table 8). These parameters were not affected by the experimental diets (P>0.05). Table (9) illustrates meat chemical composition of *longissimus dorsi* muscle of Baggara bulls. High moisture content (75.6 %) found in group C and high crude protein (22.6 %) in group B and D. No significant differences were found between treatments (P>0.05).

DISCUSSION

Feedlot performance

Feeding varying levels of sorghum straw pellets did not affect the finishing period and all bulls reached the target weight (260 kg). The dry matter intake reported in this study showed variable values, It was higher in group C (30% sorghum straw) and D (40% sorghum straw) compared to group A (10% Sorghum Straw) and B (20% Sorghum straw). This might be attributed to the lower energy content and higher fibre content in diet C and D. These results were consistent with those reported by Martens (1985), Merchen et al. (1987), Ketelaars and Tolkamp (1996) and McDonald et al. (2002). Feed intake increases as the concentration of energy in the diet decreased as reported by Mohamed (1999) and shown in Table (1).

Table 6 - Composition of high priced whole sale cut (9 - 10 and 11th rib cut) as percent of the cut weight.

Parameters	Means ±SD			
	A	B	C	D
Muscles	61.2± 5.6	58.3± 5.7	59.4± 5.8	60.8± 2.9
Bone	25.3± 3.4	25.0± 4.4	25.7± 5.5	24.8± 2.4
Connective tissue (C.T)	7.74± 5.1	7.58± 2.6	6.70± 1.4	7.18± 1.2
Fat	4.80± 1.8	6.93± 2.6	4.77± 0.8	4.93± 2.6

The average daily gain was not affected by the treatment diets (P>0.05) and these were in line with the findings of Elshafie and Mcleroy (1964), Mukhtar and Eltiriefie (1970), Eltahir (1994) and Guma (1996). However, the present results were lower than the average daily gain reported for the same breed by Gaili and Osman (1977), Mustafa (1980), Abdelgalil (1997) and Babiker (2008). Feed conversion ratio obtained in this study was affected by the experimental diets which were 9.6 kg in group B as the best value (20% sorghum straw) and 11.1 kg in group C as the least value. This may be attributed to high fibre content in the treatment diets according to the concentration of the sorghum straw. It also indicates that sorghum straw at 20% improved feed conversion ratio and seemed to

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be the optimum level when added to molasses based concentrate diet. These findings were within the range (7.29–11.3 kg) reported by Morre (1991) for Sudan Baggara cattle.

Table 7- Meat quality attribute of *Longissimus dorsi* muscle of Sudan Baggara bulls fed varying levels of sorghum straw pellets.

Parameters	Means ± SD			
	A	B	C	D
Color				
L	33.2± 2.3	34.0± 1.3	34.2± 1.5	34.1± 1.7
A	19.4± 1.7	18.8± 1.6	18.3± 2.6	18.5± 2.5
B	8.28± 0.9	7.86± 0.8	8.00± 0.3	8.09± 1.5
WHC	2.07± 0.5	1.90± 0.4	2.10± 0.2	1.47± 0.3
Cooking loss	34.7± 0.5	34.9± 0.5	36.7± 0.7	37.0± 1.9

Table 8 - Subjective evaluation of *Longissimus dorsi* muscle Sudan Baggara bulls fed varying levels of sorghum straw pellets.

Parameters	Means ±SD			
	A	B	C	D
Colour	5.34± 0.4	6.25± 0.6	5.44± 0.5	5.04± 0.4
Flavour	4.43± 1.1	4.72± 0.4	5.36± 0.3	5.01± 0.5
Juiciness	6.79± 0.3	6.40± 0.7	4.18± 0.5	3.43± 0.4
Tenderness	6.99± 0.2	6.74± 0.4	4.40± 0.4	3.76± 0.0
Overall acceptability	6.50± 0.2	7.00± 0.5	4.00± 0.4	3.50± 0.4

Sample evaluation for color (1 = extremely dark brown, 7 = brown), juiciness (1 = dry, 7 = very juicy), flavor intensity (1=bland, 6 = extremely intense), tenderness (1 = tough, 7 = tender) and over all acceptability (1 = unacceptable 7 = acceptable).

Table 9- Chemical composition of *Longissimus dorsi* muscle of Sudan Baggara bulls fed varying levels of sorghum straw pellets (percent of fresh muscle weight)

Parameters (%)	Means ±SD			
	A	B	C	D
Moisture	74.9± 0.7	75.3± 1.0	75.6± 0.3	75.2± 0.8
Crude Protein	22.1± 1.7	22.6± 1.1	21.9± 1.1	22.6± 1.4
Intramuscular fat	2.07±1.1	2.43±1.1	1.59±0.5	2.18±0.9
Ash	1.57± 2.1	0.88± 0.3	1.00± 0.4	0.90± 0.2

Results related to carcass yield were not influenced by the treated diets, however, bulls in group A and B showed slight increase in the empty bodyweight over group C and D. This may be partially attributed to the high gut fill of group C (30% sorghum straw) and D (40% sorghum straw). This goes in line with Stobo (1964) who found an association between the fibre content of the diet and rumen fill. No differences in the dressing percentage of Sudan Baggara bulls reported in this study, this may be due to the similar slaughter weight (260 kg). These findings goes in accord with Preston and Wills (1974) who reported that dressing percentage increased with the increase of live weight. In addition, the percentage of shrinkage of slaughtered bulls was affected by slaughter weight rather than the treatment. These finding is consistent with the results of Eltahir (2007) who reported that subcutaneous fat reduces the moisture evaporation when bulls slaughtered at heavier weights.

Results of meat quality attributes in this study indicated that, bulls fed high energy and protein levels showed improved water holding capacity (WHC) and lower cooking loss. This was in agreement with the conclusion obtained by Ahmed (2003) for the same breed. Panelists preferred meat obtained from bulls fed 10 and 20% sorghum straw pellets than that of 30 and 40% sorghum straw. This might be attributed to the higher juiciness and tenderness of the meat of the former bulls.

It could be concluded that pelleting of sorghum straw could improve the nutritive value and palatability for the animal. Furthermore, sorghum straw could be added to the diet to a level of 40% without negative effect, but good results could be obtained at level 20% sorghum straw.

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