Dressing percentage and carcass characteristics of Bunaji bulls fattened on varying inclusion levels of groundnut haulms and maize offal

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Abstract

Animal carcasses vary in composition through genetic, age and sex of animal, nutritional and environmental effects. Twenty Bunaji bulls with average live weights of 196±0.5 kg and aged between $2^{1}/_{2}$ and 3 years were used for the trial. The bulls were divided to four groups of five animals balanced by weight with an animal as a replicate in a completely randomized design and were allocated to four dietary treatments consisting of 80: 20, 60: 40, 40: 60 and 20: 80% groundnut haulms: maize offal. Feed intake, live and carcass weights and weight of carcass components and offal were used to assess the carcass characteristics. Feed intake and final weight differed (P<0.05) significantly with the bulls on 40: 60 and 20: 80% groundnut haulms: maize offal inclusion levels having higher values of 7.49 and 7.57 kg/d and 276.60 and 279.60 kg against 6.93 and 7.16 kg/d and 242.40 and 252.60 kg/d for those on 80: 20 and 60: 40% inclusion levels, respectively. Similarly, feed conversion ratio was significantly (P<0.05) higher for the bulls on 40: 60 and 20:80% inclusion levels than those on 80: 20 and 60: 40% inclusion levels. The carcass components used were: empty carcass (kg), dressing percentage, weight of dissectible beef (kg), beef yield % of carcass weight, internal offal (liver, spleen, heart, kidney, empty stomach and intestine) and external offal (head, tail, legs and hide). Result also showed that there was significant (P<0.05) difference in all the carcass components, dressing percentage and weight of legs spleen, kidney and empty intestines between the treatments. However, no differences were observed for the weights of liver, heart, empty stomach, head and hide. It is concluded that higher proportion of maize offal in the diet influence most carcass components.

Keywords: Dressing percentage, Carcass characteristics, Bunaji bulls, groundnut haulms and maize offal.

Introduction

The Bunaji (White Fulani) breed of cattle is one of the breeds mostly fattened by smallholder fatteners in Nigeria. Others are Rahaji, and Bokoloji or Sokoto Gudali (Adamu and Alawa, 2005; Alawa *et al.*, 2007). Reports on institutional fattening trials in the country Olayiwola *et al.*, 1981; Ikhatua and Olayiwole, 1982) showed appreciable increase of 25-40% in the liveweight of the indigenous breeds of cattle fattened in feedlots. However, cattle fattening using the conventional feed ingredients like maize grain, silage, groundnut cake and cotton seed cake has been very difficult to adopt by the smallholder farmers due to the high cost of such ingredients. The major constraint in ruminants' production in the country and indeed most sub-Sahara African countries

among others is inadequate nutrition owing to the seasonality of qualitative and quantitative herbage leading to reduced animal performance through body weight and condition loss as well as reduced carcass composition is common especially during the dry season (Lamond, 1970; Deaville *et al.,* 1994) The constraint of poor nutrition in beef production could be minimized by finishing animals in feedlot using diets based on crop residues and agro-processing by-products. Using crop residues in animal feed can be interesting when it results in low cost for the process, provided it maintains the animal production index and satisfactory animal performance (Roth *et al.,* 2009). Groundnut haulms along with cowpea, soybean threshing and cereals bran are major crop residues and agro-processing by-products used for animal fattening in the West African Sahel and other tropical countries (Ayantunde *et al.,* 2007; An, 1998; Lamidi *et al.,* 2008). Groundnut tops (haulms) after pod harvesting provides important feed resources for livestock production and is extensively fed to ruminants especially in the dry season (Njie and Reed, 1995; Olorunju *et al*., 1996). An estimated 1.3 million tonnes of groundnut haulms are reported to be produced annually in the seven major groundnut producing states of Sokoto, Kano, Bauchi, Kaduna, Benue, Borno and Adamawa ((Alhassan,1985). Tarawali and Quee (2014) also reported groundnut haulms yield per hectare to be around 1,650 to 1808kg depending on varieties and ecological zone of production. Groundnut haulms is of high nutritive value (Ayoade *et al.,* 1983; Ikhatua and Adu, 1984) and have been used intensively to supplement poor quality cereal Stover during the long (5-7 months) dry season in the Northern Guinea Savanna zone of Nigeria (Lamidi *et al.,* 2006). Maize offal is a by-product obtained from maize grain processing. It is a mixture of bran, middling, and some cobs. Maize offal is commonly used as feed for livestock in northern Nigeria where maize is largely produced. Maize offal is moderate in CP (10.82%) and is high in energy (3,432 $Kcal^{-1}$ Metabolizable energy) and it is reported to contain 91.80% dry matter, 12.70% crude protein, 8.90% ether extract, 12.80% crude fibre, 6.50% Ash, 50.80 % nitrogen free extract, 43.00% acid detergent fibre, and 4.25 kcal/g GE (Olorunnisomo *et al.,* 2006). Animal carcasses vary in composition through genetic, age and sex of animal, nutritional and environmental effects. Although heredity dictates the maximum amount of growth and development that is possible, nutrition along with other environmental factors governs the actual rate of growth and extent to which development is attained (Irshad *et al.,* 2012). Dressing percentage and other carcass characteristics gives the farmer valuable idea with which to estimate expected returns.

The study aimed at evaluating the effect of varying the proportion of groundnut haulms and maize offal as protein and energy supplements respectively on carcass characteristics of bulls to maximize the use of these feed ingredients to increase beef production and reduce animal protein deficiency in the diet of the resource poor.

Materials and methods

Location of the study

The study took place at the meat laboratory of The National Animal Production Research Institute (NAPRI) Ahmadu Bello University, Shika Zaria Nigeria. Shika is located within the Northern Guinea Savanna ecological zone of the country between latitude of 11 and 12^0N and between longitudes 7 and 33^0E at an altitude of 640m above sea level. The zone has one wet season that starts from May/ June and

ends in October. Mean annual rainfall is about 1041mm; maximum temperature varies between 27°C and 35°C depending on the season while relative humidity is about 72 %.

Animals and design of experiment

Twenty Bunaji bulls with average live weights of 196±0.5 kg were used for the trial. The bulls were divided into four groups of five animals balanced by weight with an animal as a replicate in a completely randomized design and were allocated to four dietary treatments. The bulls were dewormed with Albendazole 2500mg (Eagle Chemical Co. Ltd chungchongnamdo, Korea) and dipped in acaricides Amitix (Amitraz 12.5% by Alfasan) to control endo- and ecto-parasites a week to commencement of the trial. The bulls were individually penned and fed. The bulls were fed 1 kg/head/day of supplement ration and *ad libitum* Signal grass hay for 14 days to adjust the bulls to the various diets. After the adjustment period, supplements were offered at 2% of the animal's body weight, while *Brachiaria* hay was offered as a basal diet. These were weighed before feeding. Half of the days' concentrate was offered in the morning (between 8 and 9 am) and the remaining half was offered in the afternoon (between 4 and 5 pm). Water and mineral salt block were offered *ad-libitum.* Feed remnants were weighed the following day in the morning before the day`s feed was offered. The animals were weighed weekly and their feed offer adjusted accordingly. The study lasted 90 days and took place between May and August.

Carcass evaluation

Two bulls from each treatment were slaughtered to determine carcass composition. The bulls were slaughtered after 24 hours of feed and water withdrawal to shrunk body weight. After slaughter, the external offal (head, limb, tail and hide) were removed and weighed separately. After evisceration the internal offal (liver, spleen, kidney, heart and lungs) were removed and weighed individually. Empty carcass weight was obtained by weighing the carcass after the removal of thoracic and abdominal viscera. Dressing percentage was obtained by dividing empty carcass weight by fasted body weight expressed in percentage. The GIT was weighed with the contents and re -weighed after washing. Total lean meat (Boneless) was separated and weighed. The bones were also weighed.

Statistical analysis

To determine the response of the animals to treatments, all data collected were subjected to Analysis of Variance using the General Linear Model Procedure (GLM) of SAS (2002). Significant levels of difference among treatment means was separated by Duncan Multiple Range Test (Duncan, 1955) at 5 and 1% level of significance. The model used for the analysis was $Y_{ij} = \mu+T_i+eij$

Where μ = Overall means

T_i = effect of i^{th} treatment (i=1, 2, 3, 4)

eij= random error (The random effect assumed to be normally distributed with mean zero and equal variance ^{2} i.e $\Sigma \sim N(0, {}^2_I)$

Results and discussion

The crude protein (CP) content of signal grass hay used for this study was low, typical of tropical forage grasses that are reported to be of low CP at advance stage of growth (Minson, 1971). Signal grass is a tropical forage grass reported to contain 3.2 to 17.5% CP depending on soil fertility, management and stage of growth (Loch, 1977). The CP value of signal grass (which was harvested after seeding) agrees with the report by Sampaio *et al.* (2010) (4.86%) and was below the 7-8% required for maintenance of body weight and critical for

microbial growth and roughage intake (Warly *et al.,* 1992; Fall, 1990; Abdulrazak *et al*., 2005) and therefore can be regarded as a low quality feed (Leng, 1990). Therefore it was necessary to supplement the bulls with protein sources. The crude fibre content of signal grass was within the range reported by Loch (1977) and within the minimum level (17%) required by beef cattle (NRC, 2000). The CP content of GH was within the range reported by Abubakar *et al.* (2010); Addass *et al.* (2011) and Jadalla *et al.* (2012) but was higher than the value (11.22) reported by Lakpini and Adu (1987). However, the value reported in this work was lower than reported by Iyeghe-Erakpotobor *et al.* (2006).This might be due to differences in stage of growth at harvest and preservation method. The CP content of GH fed with MO met the requirement of the bulls, hence the reasonable weight gain obtained. The digestible CP value of GH is reported to be superior to non-leguminous hays and is comparable to that of leguminous cowpea. Groundnut haulms can be safely fed along with wheat bran to meet the entire nutritional requirement of lactating cow producing 5 liters of milk per day (Ranjhan, 1993). The CP content of maize offal (12.65%) was in agreement with the report by Vantsawa *et al.* (2007). This contributed significantly to the CP supplied from the concentrate mixtures. The significant differences observed in final weight, weight gain, average daily gain and feed conversion (Table 2) between treatments might have resulted to the variation in the dressing percentage and the weight of most carcass components(dissectible beef, beef yield as percentage of carcass weight and meat : bone ratio) with increasing level of maize offal inclusion. This agrees with the report by Rotta *et al.* (2009) that the feeding system and the diet can influence cattle carcass and meat characteristics. It has also been demonstrated that carcass traits including dressing percentage are influenced by several factors such as plane of nutrition, sex and age of the animal (Devendra and Burns, 1983).

Table 1: Ingredients and chemical composition of the concentrates with inclusion levels of groundnut haulms and maize offal (%)

	Inclusion levels of GH and MO (%)			
	T_1	T_2	T_3	T_4
Nutrients	GH: MO 80: MO	GH: MO 60: 40	GH: MO 40: 60	GH: MO 20: 80
Groundnut haulms	80.00	60.00	40.00	20.00
Maize offal	19.06	38.91	58.80	78.70
Urea	0.94	1.09	1.20	1.30
Total	100.00	100.00	100.00	100.00
Chemical composition				
Dry matter	95.71	95.20	94.46	94.29
Crude protein	16.38	16.41	16.43	16.25
Crude fibre	24.94	21.17	17.01	13.53
Ether extract	8.17	10.71	11.15	12.15
Organic matter	88.16	94.78	94.99	95.81
Neutral detergent fibre	40.04	36.46	31.08	32.21
Acid detergent fibre	30.30	22.21	19.75	15.91
Ash	11.84	5.22	5.01	4.19
ME (MJ/Kg DM)	10.98	10.89	11.04	11.16

GH =Groundnut haulms, MO = Maize offal, ME = Metabolisable energy (MJ/Kg DM)
ME values of feed ingredients and experimental diets were calculated as per Alderman and Cottrill (1985) as follows:ME (MJ/kg DM)=11.78 + 0.00654CP + (0.000665EE) ^{2} - CF(0.00414EE) – 0.0118A where DM=Dry Matter, C= Crude Protein, EE= Ether Extract, CF= Crude Fibre, A= Ash

Table 2: Performance characteristics of bunaji bulls fed varying inclusion levels of groundnut haulms and maize offal (%)

	Inclusion levels of GH and MO (%)				
	T_1	T_2	T_3	T_4	
Parameters	GH: MO 80: 20	GH: MO 60: 40	GH: MO 40: 60	GH: MO 20: 80	SEM
Dry matter intake (kg)	6.93^{c}	7.16^{b}	7.49^{a}	7.57^{a}	0.02^{*}
Initial weight	197.00	196.80	197.20	196.80	3.61ns
Final weight	242.40^{c}	252.60^{b}	276.60^{a}	279.60^{a}	4.26^{*}
Weight change	45.40^{c}	55.80^{b}	79.40^{a}	82.80^{a}	2.72^{**}
Average daily gain	0.50^{d}	0.62^{c}	0.88^{b}	0.92^{a}	0.03^{**}
Feed conversion ratio	13.86^{b}	16.16^{b}	8.60^{a}	8.31^{a}	1.47^{*}

^{abcd} Means with different superscripts along the row differ significantly (P< 0.05) or (P <0.01), ns= not significant, *= P <0.05, ** =P <0.01 , SEM= Standard error of means, FCR= Feed co nversion ratio,GH= groundnut haulms, MO= maize offal.

Table 3: Dressing percent, weight of hot carcass and edible offal of bunaji bulls fattened on diets containing groundnut haulms and maize offal

	Inclusion levels of GH and MO (%)				
Parameters	T_1 GH:MO 80 : 20	T_2 GH:MO 60 : 40	T_3 GH:MO 40 : 60	T_4 GH:MO 20 : 80	SEM
Live weight (Kg)	249.50	250.00	263.50	265.50	18.46^{ns}
Empty carcass weight (Kg)	135.50^{ab}	133.00^{b}	155.50^{a}	150.00^{ab}	11.18^{*}
Dressing percent	54.27^{c}	53.19^{c}	58.91^{a}	56.43^{b}	0.86^{*}
Weight of dissectible beef (Kg)	74.50^{b}	70.50^{b}	89.75^{a}	80.50^{ab}	7.46^{*}
Beef yield (% of carcass weight)	54.89^{ab}	52.45^{b}	57.66^{a}	53.83^{b}	1.88^{*}
Bone yield (Kg)	11.85^{ab}	11.25^{b}	12.50^{a}	13.00^{a}	0.64^{*}
Meat :bone ratio	6.25^{ab}	6.20^{b}	7.22^{a}	6.22^{ab}	0.50^{*}
Legs (Kg)	6.25^{b}	6.25^{b}	6.6^{ab}	6.77^{a}	0.25^{*}
Hide (Kg)	17.50	16.00	18.75	19.00	2.11^{ns}
Head (Kg)	17.75	16.50	16.65	17.50	1.02^{ns}
Liver (Kg)	3.50	4.20	4.00	3.67	0.45^{ns}
Spleen (Kg)	0.65^{b}	0.60^{b}	0.62^{b}	1.05^{a}	0.04^{*}
Heart (Kg)	0.85	0.77	0.80	0.90	0.08^{ns}
Kidney (Kg)	0.52^{b}	0.62^{ab}	0.45^{b}	0.70^{a}	0.05^{*}
Empty stomach (Kg)	8.70	8.45	7.25	7.55	0.74^{ns}
Empty intestine (Kg)	5.65^{ab}	6.49^{a}	5.75^{ab}	5.35^{b}	0.44^{*}

^{abc} Means with different superscripts along the row differ significantly (P<0.05) , ns=not significant, *= P <0.05, SEM= s tandard error of means, GH = Groundnut haulms, MO = Maize offal

The weight of empty carcass of the bulls ranged between 133.50 and 155.50 kg. There were similarity (P>0.05) in empty carcass weight between the bulls fed diets with 80: 20, 60: 40 and 20: 80%GH; MO inclusion levels. Bulls fed on 40: 60%GH: MO inclusion level had significantly (P<0.05) higher empty carcass weight than those fed 60: 40%GH: MO inclusion level. Dressing percentage of the bulls in this study which ranged from 53.19 to58.91% was higher than the report of Olayiwole *et al.* (1975) and Lamidi *et al.* (2007) for Bunaji bulls. However, it was lower than

64.43-66.26, 69.4 and 69.54% reported by Lamidi (2005); Buvanendran *et al.* (1981) and Madziga *et al. (*2016) for Bunaji breed. The report in this study did not agree with the report by Micheal *et al.* (2002) that there was no difference in dressing percentage in Zebu oxen fed teff straw and supplemented with different levels of wheat bran. Differences in dressing percentage of the bulls in the present study agrees with the report by Feyera and Animut (2011) for Horro sheep supplemented with wheat bran, Acacia albida leaf meal and their mixture and the report by Jabbar and Anjum (2008) for Lohi lambs fattened on different forage to concentrate ratio.

Weight of non-carcass components except legs, spleen and empty intestines were not affected by treatment in agreement with the report by Amani *et al.* (2009) who showed that nutritional treatment imposed no effect on non-carcass components of Sudan desert lambs.

Conclusion

From the finding of this study, increasing the proportion of maize offal in a groundnut haulm: maize offal concentrate supplement to an optimum level of 40:60% for cattle fattening gave higher carcass dressing percentage, dissectible beef and meat: bone ratio. It was concluded that farmers should feed more of readily fermented energy source to less legume hay as supplements to beef cattle for better return in terms of carcass yield.

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