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EFFECT OF DIFFERENT ENERGY SOURCES ON INTAKE AND WEIGHT GAIN OF WHITE FULANI CATTLE

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ABSTRACT

A study was conducted to determine the effect of inclusion of Maize offal, Wheat offal, Rice offal and Sorghum panicle as energy sources in the fattening diet of cattle. Twenty White Fulani bulls of average weight of 225kg were used. A Completely Randomizes Design was used and five bulls were allotted to treatment. The result showed that bulls on the Wheat offal and Maize offal treatments had significantly ($p<.05$) higher intake of the concentrate while the intake of the basal *Bracharia* hay was similar across all treatments. Total feed intake was however significantly ($p<0.05$) higher in bulls fed the Wheat offal based diet. Average daily Weight Gain has significantly ($p<0.05$) high in the Wheat based bulls. It was concluded that Smallholder cattle farmers can adopt the use of the Maize offal and wheat offal based diets in fattening rations.

KEYWORDS: Energy, Intake, Weight Gain, Cattle

INTRODUCTION

A major constraint of the livestock industry in meeting consumer demand for meat, milk, egg and other livestock products in Nigeria is the unavailability of regular supplies of appropriate, cost effective and safe animal feeds. Animal feeds have become an increasingly critical component of the integrated food chain (FAO, 2004). This poor level of livestock nutrition translates into inadequate outputs of animal products for human consumption. This is in spite of the large livestock population in the country (Cattle 13.9million, Sheep 22.1million and Goats 34.5million) (Bourn *et al.*, 1994).

Meat from ruminants form the major source of animal protein in the country. The efficient management of ruminants in the tropics must first rely on the type and quality of forage available an on the supplementation required to provide adequate diet. The available feed resources are mainly range grasses, crop residues and agro-industrial by-products which are low in nutrient status and digestibility (Jokthan *et al.*, 2009). While beef producers rely heavily on forages as the basis of feeding programmes, forages must of necessity be supplemented with energy and or protein if fast growth rates are to be achieved. In developed countries, production of quality beef is usually achieved through the feeding of high energy rations to cattle. The bulk of the beef produced in the developing countries however, still comes from extensive production system. A rapid expansion of beef production in developing countries could be achieved through the implementation, on a significant scale, of intensive growing and finishing schemes. Crop and agro-industrial by-products thus, have a significant role to play being cheap and sources of animal feed. The use of agricultural by-products in animal feeding can be optimized to help overcome periods of shortage and ensure a constant supply of livestock products throughout the year. It is necessary therefore to exploit locally available feed resources and to develop feeding strategies compatible with the local environment. Feed accounts for about two-thirds of the cost of meat production and the breakdown of feed expenses shows that the largest portion of the cost is attributable to energy supplied (85%-90% of the total) (Vecchiettini and Giardini, 2000)

Over the years, it has become uneconomical to include grains in the diets of ruminnts due to increased consumption of grains by humans, however, industrial and home processed by-products of cereal grains (maize, sorghum, millet, wheat, rice) have been used as energy sources for beef cattle. These by-products have individual nutritional attributes, and could be better supplements to pasture or hay feeding systems. These alternative feeds can fit into a feeding program as the primary roughage, a supplement to a regular ration or as a replacement of part of the ration (Myer, 2008). The use of agro-industrial by-products as animal feed has been a common practice for decades in industrialized nations where millions of tones are produced each year.

Conventional protein and energy concentrates such as cotton seed cake, groundnut cake and whole maize have no relevance under traditional small holder fattening operations. Instead, the farmers utilize locally available feedstuffs found within their farming system. These locally available feedstuffs include maize offal ("dusa"), rice offal, sorghum panicle ("keikei") and wheat offal. Although live weight gains under this system appear to be low, it can be improved by determining optimal combinations of these resources that can promote better live weight gains.

MATERIALS AND METHODS

A fattening trial was conducted using 20 White Fulani bulls with a live weight range of 185kg to 265kg and an average weight of 225kg. The bulls were allotted to four treatments in a Completely Randomize Design (CRD) with 5 animals per treatment. Diets comprising of maize offal, wheat offal, rice offal and sorghum panicle were formulated. The diets were isonitrogenous. Other components of the diet were cotton seed cake, poultry litter, bone meal and salt. The study lasted for 3 months. Table 1 shows the composition of the experimental diets.

Animal's Management

The bulls were purchased at a local cattle market in Sheme, Katsina State, Nigeria. On arrival, the animals were dewormed (Albendazole® – 10mls per animal), given antibiotics (Terramycin® L/A – 5mls per animal) and treated against ecto-parasites by dipping. The bulls were then housed individually and tagged using ear tags for identification. Their feacal remains were removed daily and the environment was kept clean to avoid disease outbreak. The bulls were fed 5kg/head/day for 14days to adjust the bulls to the various treatments diets. When the trial started, concentrates were fed at 2.5% of body weight and hay (*Brachiaria decumbens*) was fed *ad libitum*. The rations were adjusted at regular intervals of two weeks along with changes in live weight. Water was provided *ad libitum.*

The animals were weighed at the beginning of the experiment for their initial weight and subsequently weighed every 2 weeks.

Weighed left over feed was subtracted from total feed offered to obtain the feed consumed. The weekly feed consumptions and weight gained were used to compute the Feed Conversion Ratio (FCR). Fresh water of known volume was offered each day; and before each offer, the previous day's left over water was measured. Daily water consumption was thus obtained by subtracting left over water from the total volume of water offered. Two control drinkers were placed in the experimental house at different locations to account for evaporative losses.

Analysis of Feed and Feacal Samples

The individual feed ingredients (maize offal, wheat offal, rice offal, sorghum panicle, cotton seed cake, poultry litter and bone meal), formulated diets, hay (*Brachiaria decumbens*) and feacal samples were subjected to proximate analysis (AOAC 2000). Energy was determined by an equation that was developed by Alderman and Cottrill (1995):

Neutral Detergent Fibre (NDF) and Acid Detergent Fibre (ADF) were also determined using the procedure of Van

Soest (1991). Urine samples were analysed for their nitrogen content using the Kjeldahl procedure (AOAC, 2000). The analysis was conducted at the central laboratory of National Animal Production Research Institute (NAPRI), Shika, Zaria.

Data Analysis

Data from the experiment were subjected to ANOVA as described by Steel and Torrie (1980) using the SAS general linear model (SAS, 2005). Significant levels of differences among means were also separated using Duncan Multiple Range Test (Duncan 1955).

RESULTS AND DISCUSSIONS

The chemical composition of the cereal by-products is shown in Table 2. The result of the laboratory analysis showed that the DM of all the cereal by-products were similar. The crude protein (CP) and Nitrogen Free Extract (NFE) of Maize offal (MO) and Wheat offal (WO) were higher than those of Rice offal (RO) and Sorghum panicle (SP). However, Wheat offal had the highest CP. Ash content of rice offal and Sorghum threshed panicle were higher than those heads of Maize offal and Wheat offal. Wheat offal had similar Metabolizable energy (ME) with maize offal but it was higher than that of rice offal and sorghum threshed panicle. Rice offal had the lowest ME.

The CP content of the hay was 4.25% which was lower than that of the cereal by-products. The CF of Rice offal and Sorghum panicle were higher than those of maize offal and Wheat offal. However, Rice offal had the highest CF while maize offal had the least. The CF of the hay (38.17%) was lower than that of rice offal but higher than maize offal and wheat offal. Hay had an ME value that was similar to that of Sorghum panicle but higher than that of Rice offal and lower than that of Wheat offal and maize offal.

The ME of the diets were within the range of 10.93 – 11.21MJ/kg DM which are within the range of 10 – 11.6MJ/kg DM recommended for bulls (Rutherglen, 1995). The CP of the experimental diets were within the range of 12.31% - 15.91%. These values are within the CP requirement of beef cattle stated by Rutherglen (1995) and Aduku (2005) as 13% - 15% respectively. The CF of Maize offal and Wheat offal based diets were lower than the minimum level of 17% required for beef cattle (NRC, 2000). However, the CF of Rice offal and Sorghum panicle based diets exceeded the minimum level. This variation in the CF of the diets is attributed to the high CF of Rice offal and Sorghum panicle (Table 2). The EE of all the diets were higher than the maximum recommended level of 6% for matured cattle (Parish and Rhinehart, 2008). This could be due to the presence of cotton seed cake in the diets. This high fat level did not negatively affect the animals as there was no incidence of diarrhea.

Feed Intake

The concentrate intake, hay intake and dry matter intake (kg/day) are shown in Table 4. The concentrate intake was similar for Maize offal, Wheat offal and Rice offal based diets (4.96kg/day, 5.23kg/day and 4.83kg/day respectively) but were significantly ($P<0.05$) higher than the intake of Sorghum panicle based diet. There was however, no significant difference ($P>0.05$) in hay intake across the diets. Concentrate intake was inversely related to hay intake in all the diets. Wheat offal, Maize offal and Rice offal based diets had similar dry matter intakes (DMI). Wheat offal based diet was significantly ($P<0.05$) higher than Sorghum panicle based diet. There was no significant ($P>0.05$) difference in the dry matter intake (DMI) of Maize offal, Rice offal and Sorghum panicle based diets.

The concentrate intake was higher than the hay intake in all the diets. This can be attributed to the fact that with increased concentrate feeding, forage intake declines due to substitution effect (Jokthan *et al*., 2009). The high concentrate

intake could also be due to the palatability of the concentrates over the hay. The high presence of cotton seed cake in the Rice offal and Sorghum panicle based diets could also have influenced their intake as cottonseed cake supplementation increases intake (Yahaya *et al.,* 1999). The high DMI intake of bulls on the Wheat offal based diets might be due to the quality of the hay. Hersom (2007) reported that the greater the forage quality the greater the potential for increased DMI by cattle. The total feed intake in all the diets (7.82-9.14kg/day) were higher than 6.26 - 6.45kg/day obtained in fattening trials conducted by Lamidi *et al.* (2007).

Water Intake

The result of water intake is shown in Table 4. Water intake in animals fed Wheat offal based diet (33.78l/day) was significantly ($P<0.05$) higher than the other diets. There was no significant ($P>0.05$) difference in the water intake of animals fed Maize offal, Rice offal and Sorghum panicle based diets. The intake water by the bulls in all the diets was influenced by amount of DM consumed. This agrees with the findings of Hicks *et al* (1998) that water consumption increases with increase in DMI. The water intake in all the diets were between the range of 29.54l/day – 33.78l/day. Only bulls fed Wheat offal based diet achieved the minimum requirement of 32L/day for mature bulls recommended by NRC (2000). The low water intake could have been due to the environmental temperature (21-30^{o}C) and the relative humidity (72%) at the period of the study. The weight gain of the bulls was low relative to weight gain of bulls reported in other fattening trials where gains of 0.87kg/day (Ikhatua and Olayiwole, 1982), and 0.69-0.91kg/day (Lamidi *et al.,* 2007) were obtained.

Weight Gain and Feed to Gain Ratio

The results of the body weight gain showed that bulls fed Wheat offal and Maize offal based diets were similar and significantly ($P<0.05$) higher than bulls on Rice offal and Sorghum panicle based diets. There was no significant ($P>0.05$) difference in the total weight gain of bulls fed Rice offal and Sorghum panicle based diets. The results for the average daily gain (ADG) were similar to the total weight gain for all the treatments. The results also showed that the feed to gain ratio in the Rice offal based diet was similar to that of the Sorghum panicle based diet. There was no significant ($P>0.05$) difference in the feed to gain ratio of Maize offal, Wheat offal and Sorghum panicle based diets.

The weight gain of bulls fed Maize offal and Wheat offal based diets was similar to value of 0.7kg/day reported by Aduku (2005). The weight gain in the Wheat offal based diet exceeded the value of 0.5kg/day obtained by Scarr (1986) who fed wheat offal based diet. However, the weight gain of bulls in all the diets were lower than values obtained in other fattening trials earlier conducted in Nigeria. Higher gains of 0.87kg/day (Olayiwole *et al.,* 1981), 1.07kg/day (Ikhatua and Olayiwole, 1982), and 0.69-0.91kg/day (Lamidi *et al.,* 2007)

CONCLUSIONS AND RECOMMENDATION

The result showed that the nutrient in Maize offal and Wheat offal based diets were similar and higher, making them more nutritious and of benefit to beef cattle. The bulls on Wheat offal based diets had the highest DMI (kg/day). Average Daily Gain and Feed Intake were higher in animals fed Maize offal and Wheat offal based diets and the feed to gain ratio was higher and similar in both diets, indicating better rate of conversion of feed to meat. Smallholder cattle farmers can adopt the use of the Maize offal and wheat offal based diets in fattening rations.

Table 1: Percentage Composition of Experimental Diets

Ingredients	Treatments			
	Maize Offal Based Diets	Wheat Offal Based Diet	Rice Offal Based Diet	Sorghum Panicle Based Diet
Maize Offal	59.12	0.0	0.0	0.0
Wheat Offal	0.0	68.28	0.0	0.0
Rice Offal	0.0	0.0	44.26	0.0
Sorghum panicle	0.0	0.0	0.0	39.96
Cotton seed cake	19.69	15.11	27.12	29.27
Poultry Litter	19.69	15.11	27.12	29.27
Bone	1.00	1.00	1.00	1.00
Salt	0.50	0.50	0.50	0.50
Total	**100.00**	**100.00**	**100.00**	**100.00**

Table 2: Nutrient Composition of Cereal by-Products and Hay

Nutrients (%)	Cereal By-Products				
	Maize Offal	Wheat Offal	Rice Offal	Sorghum Panicle	Hay
Dry Matter	91.97	91.57	93.34	94.40	94.18
Crude Protein	12.69	16.13	6.13	4.89	4.25
Ether Extract	16.43	10.99	9.01	6.44	7.07
Crude Fibre	10.12	12.71	45.90	29.29	38.17
Ash	2.62	5.08	15.41	17.31	4.77
Nitrogen Free Extract	58.14	55.09	23.55	42.07	45.74
ADF	33.41	47.50	48.14	59.46	57.23
NDF	55.15	65.06	75.37	71.76	81.85
ME (kcal/kg DM)	2660.74	2687.02	2371.74	2586.70	2538.93

MO= Maize Offal, WO = Wheat Offal, RO = Rice Offal, SP = Sorghum Panicle
ADF= Acid Detergent Fibre, NDF= Neutral Detergent Fibre
ME= Metabolizable Energy

Table 3: Nutrient Composition of Experimental Diets

Nutrients (%)	Treatments			
	Maize Offal Based Diet	Wheat Offal Based Diet	Rice Offal Based Diet	Sorghum Panicle Based Diet
Dry Matter	92.61	91.81	92.94	93.88
Crude Protein	15.91	13.94	12.31	14.50
Ether Extract	10.64	10.58	9.39	7.45
Crude Fibre	13.96	12.48	30.09	22.54
Ash	10.93	9.80	18.34	21.17
Nitrogen Free Extract	48.74	53.20	29.87	34.34
ADF	61.32	23.59	50.87	47.53
NDF	75.72	35.72	53.06	68.86
TDN	79.58	80.10	63.19	61.09
ME(kcal/kg DM)	2660.74	2677.46	2500.72	2610.59

MO= Maize Offal, WO = Wheat Offal, RO = Rice Offal, SP = Sorghum Panicle
ADF= Acid Detergent Fibre, NDF= Neutral Detergent Fibre. TDN= Total Digestible Nutrients,
ME= Metabolizable Energy

Table 4: Effect of Experimental Diets on Performance

Parameters	Treatments				SEM	LOS
	Maize Offal Based Diet	Wheat Offal Based Diet	Rice Offal Based Diet	Sorghum Panicle Based Diet		
Conc. Intake (kg/day)	4.96[a]	5.23[a]	4.83[a]	4.28[b]	0.15	*
Hay Intake kg/day)	3.53	3.91	3.87	3.54	0.14	NS
Total Feed Intake (kg/day)	8.49[a b]	9.14[a]	8.70[a b]	7.82[b]	0.29	*
Dry Matter Intake (kg/day)	7.93[a b]	8.50[a]	8.14[a b]	7.36[b]	0.27	*

Table 4: Contd.,

Water Intake (l/day)	30.54 [b]	33.78 [a]	29.54 [b]	28.69 [b]	1.01	*
Initial Weight (kg)	254.80	263.20	254.40	242.60	11.35	NS
Final Weight (kg)	309.00 [a b]	319.00 [a]	288.00 [a b]	280.00 [b]	10.94	*
Total Weight Gain (kg)	54.20 [a]	55.80 [a]	33.60 [b]	37.40 [b]	4.62	*
Average Daily Gain (kg/day)	0.65 [a]	0.66 [a]	0.40 [b]	0.45 [b]	0.06	*
Feed : Gain ratio	13.71 [a]	14.30 [a]	22.40 [b]	19.27 [a b]	2.18	*
Cost of Feed Intake (₦ /day)	288.59 [b]	328.88 [a]	265.35 [b c]	238.63 [c]	9.17	*
Feed Cost/kg gain (₦)	466.14	514.74	683.10	587.60	69.11	NS

Figures bearing different superscript in a row differ significantly. SEM = Standard Error of Mean. LOS = Level of Significance; *=P<0.05; NS = Not Significant

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