Journal of Agriculture and Social Research (JASR) Vol. 12, No. 1, 2012

COMPARATIVE DIGESTIBILITY AND NITROGEN BALANCE OF MAIZE BRAN, WHEAT OFFAL AND RICE BRAN IN WEST AFRICAN DWARF GOATS

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ABSTRACT
Nine bucks West African Dwarf goats (WADg) of 8-10 months with average initial weight of 8.5±0.05 were allotted to individual metabolic cages in a CRD in a 21-days experiment to compare the digestibility and nitrogen balance of maize bran (MB), rice bran(RB) and wheat offal (WO) in WADg. Results shows that DM value ranged between 83.20% MB and 90.30% in RB while WO had the highest 11.43% of CP, ADF value ranged between 58.00% in WO to 63.00% in MB. CP intake was significantly ($p<0.05$) higher in goat placed on WO than other animals.. The value of CF, ADF, NDF and Ash intake was significantly similar ($p>0.05$) in goat fed WO and RB. The DM digestibility were significantly ($p<0.05$) higher (56.00%) in goats fed WO followed by RB and MB with 42.08% and 40.57% respectively. The apparent digestibility of CP were similar ($p>0.05$) in all the animals, CF digestibility were lower (10.80%) in animals fed WO. Acid detergent fibre (ADF) and NDF digestibility were significantly ($p<0.05$) higher (88.52%) and 58.33% in animal fed with RB. Nitrogen intake varied significantly ($p<0.05$) across the treatments with 1.96g/day in goat fed MB followed by 2.66g/day MB and 3.84g/day in animal fed WO. Animals fed WO and RB had highest significantly ($p<0.05$) 2.16g/day and 2.20g/day of N-balance. The positive N-balance observed in all goats suggested that N absorbed was well tolerated and utilized by the animals, so the treatments gives a better chance for dry season feed or when animals are tethered without any adverse effects.

Key Words: Nutrients, Digestibility, Nitrogen balance, and West African Dwarf goats

INTRODUCTION
Ruminants in the tropics in general, are raised predominantly on grasses which are inherently poor in digestibility, nutritive value and unavailability in off season (Babayemi *et al*., 2009). At this period, the performance of the ruminant animals which is dependent on the native pasture is seriously impaired, the quality is associated with the fibrous and lignified nature of the pasture which limits intake, digestibility and utilization (Olafadehan *et al*., 2009). Meanwhile, during this critical period the production level of the animal is low and consequently resulted to the low income accruable from these animals, farmers lose some of the animals through premature disposal or death in some cases. Farmers who do not sell prematurely raised the animal on concentrate which is high in price, the level of the farmers' financial capability can not sustain ruminant animal production of this nature in the tropics. Considering this fact ruminant farmers need to place the animals on the feed

that is relatively cheap which will meet the nutrients requirements of these animals at this crucial situation.

Agro-industrial by-products stand the greater chance of effective and efficient utilization at this period because of its availability and storability. Agro-industrial by-products such as maize bran (MB), rice bran (RB) and wheat offal (WO) has been used to form different rations for livestock especially ruminant. However, much has not been done in assessing and establishing their uses as a sole feed for this animal especially small ruminant animal, this materials has low content of crude protein and other nutrients, ruminant animals has the ability to utilize low quality material to form edible products such as meat, milk, skin and hide. The focus of this study is to assess the nutritional potential of rice bran, maize bran and wheat offal, through digestibility trial and nitrogen balance.

MATERIALS AND METHODS

Description of study site

The study was conducted in the Experimental Unit, Small Ruminant Section of College of Animal Science and Livestock Production (COLANIM) Teaching and Research farms. University of Agriculture Abeokuta, Abeokuta, Ogun State (South Western Nigeria), which falls under the derived savannah transition zone. The altitude of the region is of 70 meters above sea level and falls within latitudes $7^0$5 - $7^0$8 and longitudes $3^0$11.2 – $3^0$2.5'E. The climatic condition is humid with a mean temperature and humidity is 34.7^0c and 82% respectively.

Experimental feed

Rice bran and maize bran were obtained from commercial milling centres in Abeokuta, Ogun State while wheat offal was obtained from the Flourmills Apapa, Lagos State (South Western Nigeria).

Experimental animals and management

Nine male West African Dwarf (WAD) goats were used for this study. The animals were about 8 – 10 months old with average body weight of 8.5 ± 0.15kg. They were randomly allocated to three experimental treatments of sole maize bran (MB), wheat offal (WO) and rice bran (RB). The goats were housed in individual metabolism crates where the quantity of feed intake, faecal and urinary output were monitored over the period, during which 10% aliquot of the total faeces and urine were collected quantitatively and bulked for each animal. Nitrogen loss from the urine volatilization was prevented by introducing 10ml of 10% H_2SO_4 into the urine samples (Chen and Gomez, 1992). All feed and faecal samples were determined according to A.O.A.C. (1995). The NDF and ADF were determined according to Van Soest *et al*. (1991). Sample were analysed in triplicates and also analysed for nitrogen by the macro-kjeldahl method. Data obtained were subjected to analysis of variance and significant means separated using Duncan (1955) multiple range test.

RESULTS

The proximate compositions of the experimental treatment are shown in Table 1. The dry matter (DM) value ranged between 83.20% MB and 90.30% in RB while WO had highest 11.43% of CP, MB and RB had 9.42% and 10.37% CP respectively. The value of EE for WO and RB were similar (13%) while highest EE (15%) was recorded for MB. Rice bran had the highest value of CF (15%) followed by MB (11.85%) and WO (10.00%). Acid detergent fibre (ADF) value ranged between 58.00% in WO to 63.00% in MB.

Table1: Proximate composition of experimental treatments

Parameters	MB	RB	WO
DM	83.20	90.30	86.10
CP	9.42	10.37	11.43
EE	15.00	13.00	13.00
CF	11.85	15.00	10.00
ADF	63.00	61.00	58.00
NDF	70.00	72.00	52.00
Ash	2.50	9.00	5.00

Wheat offal had least of NDF (52.00%) while 70.00% and 72.00% was recorded for MB and RB. The ash percentage of the experimental feedstuffs ranged between 2.50% to 9.00% in MB and RB respectively while WO had 5.00% ash.

Table 2 depict the voluntary feed intake (VFI g/day) and daily nutrients intake (g/day) of the animals fed with maize bran, wheat offal and rice bran. There was a significant difference ($p<0.05$) in the VFI of the animals. Goat placed on WO had the highest VFI (210g/day) compared with other goats RB (160g/day) and MB (130g/day).

Table 2: Average Voluntary Feed Intake (VFI) and daily nutrient intake (g/day

Parameters	MB	RB	WO	SEM
VFI	130.00^{c}	160.00^{b}	210.00^{a}	1.14
DM	107.9^{c}	144.00^{b}	180.60^{a}	1.02
CP	12.25^{c}	16.62^{b}	24.01^{a}	0.53
EE	19.50^{c}	20.81^{b}	27.3^{a}	0.34
CF	15.40^{b}	20.80^{a}	$21.o1^{a}$	0.73
ADF	81.90^{b}	97.60^{ab}	121.80^{a}	1.20
NDF	91.01^{b}	115.20^{a}	109.23^{a}	1.34
Ash	3.25^{b}	14.42a	10.54^{b}	0.64

a, b, c, means with different superscripts on a row are different ($p<0.05$)

The dry matter intake (DMI) significantly ($p<0.05$) difference among the goat fed the experimental treatment, DMI value ranged between 107.9g/day MB to 180.6g/day WO. Crude protein intake was significantly ($p<0.05$) higher in goat placed on WO than other animals, while least CP intake (12.25g/day) was noted in goat fed MB. The value of EE intake also ranged 19.5g/day in animal fed MB to 27.3g/day in WO. The value of CF, ADF, NDF and Ash intake was significantly similar ($p>0.05$) in goat fed WO and RB while goat placed on MB had a least value.

Apparent digestibilities of experimental treatments were indicated in Table 3. The DM digestibility were significantly ($p<0.05$) higher (56.00%) in fed WO followed by RB and MB with 42.08% and 40.57% respectively. The apparent digestibility of CP were similar ($p>0.05$) in all the goats. Ether extract digestibility were ranged between 46.15% in goat fed WO to 80% in animal placed on MB, CF digestibility were lower (10.80%) in animals fed WO. Acid detergent fibre (ADF) and NDF digestibility were significantly ($p<0.05$) higher (88.52%) and 58.33% respectively in animal fed with RB.

Table 3: Apparent digestibility of experimental treatment (%)

Parameters	MB	RB	WO	SEM
DM	40.57[b]	42.08[b]	56.00[a]	0.64
CP	53.92	48.60	55.49	0.21
EE	80.00[a]	69.23[b]	46.15[c]	0.66
CF	40.31[a]	29.27[b]	10.80[c]	0.29
ADF	23.80[c]	88.52[a]	32.69[b]	0.68
NDF	21.42[b]	58.33[a]	17.24[a]	0.32

a, b, c, means with different superscripts on a row are different ($p<0.05$)

Table 4 shows the nitrogen utilization of WAD goat fed MB, WO and RB. The nitrogen intake varied significantly ($p<0.05$) across the treatments with 1.96g/day in goat fed MB followed by 2.66g/day MB and 3.84g/day in animal fed WO. The N-faecal and N-urine were higher in goat fed WO. Higher total N-excreted (1.48g/day) was noticed in RB goats. Animals fed with WO and RB had highest significantly ($p<0.05$) 2.16g/day and 2.20g/day of N-balance.

Table 4: Nitrogen Utilization of West African Dwarf goat fed maize bran, rice bran and wheat offal

Parameters	MB	RB	WO	SEM
N-intake (g/day)	1.96[b]	2.66[b]	3.84[a]	0.21
N-faecal (g/day)	0.69[c]	0.85[b]	1.12[a]	0.20
N-urine (g/day)	0.58[a]	0.54[b]	0.56[ab]	0.32
N-total excreted(g/day)	1.27[b]	1.48[a]	1.18[c]	0.12
N-balance (g/day)	0.69[b]	2.20[a]	2.16[a]	0.14

a, b, c, means with different superscripts on a row are different ($p<0.05$)

DISCUSSION

The proximate composition of the experimental treatment in this study were within the range of value of similar feedstuffs reported earlier, Lamidi, (2009) 89.88%DM, 12.38% CP for wheat offal. The CP range 9.42 to 10.37% recorded in the experimental feedstuffs is much above the critical level of 8% for ruminants as reported by NRC(1996) which is necessary to provide minimum ammonia levels required by rumen micro organism to support optimum activity (Gatenby, 2002; Norton, 2003). This implies that the experimental treatments would provide adequate nitrogen requirement by rumen micro-organism to maximally digest the main components of dietary fibre leading to the production of volatile fatty acid (Trevaskis *et al*., 2001) which in turn facilitates microbial protein synthesis (Lamidi, 2009). The CF of 20.75% can be tolerated by ruminants. (NRC 1991). It implies that 10.00% to 15.00% CF recorded for this experimental treatment is much lower to the CF recommended by NRC. The range of CF obtained in the present study (10- 15%CF) is higher than 6.19 to 8.39% reported by Olatunji *et al*. (2007).

The VFI (g/day) ranged between 130g/day to 210g/day in goat fed MB and WO respectively, it was higher than 10.5 to 16.66g/day reported by Isah *et al*. (1999) for WAD goats fed mango and gliricidia leaves based diets. The increased VFI recorded in animal placed on WO might be attributed to the level of NDF which corroborate the assertion of Van Soest *et al*., 1994 which says that the NDF content of feed can be used to predict the feed intake since it measure the total fibre component

of feed. The highest CP intake in goat placed on WO noticed could be due to the highest proportion of CP in the treatment.

The DM, CP digestibility values were medium in all the experimental treatments except CF, NDF and ADF digestibility which were low in animal fed WO and RB .The generally low nutrient digestible of animals offered MB,WOand RB may be attributed to the sub-optimal rumen degradable carbohydrates or other nutrients were present. This observation agrees with earlier reports (Oddoye *et al*., 2005) that for rumen microbial flora to perform at optimum level, the presence of nitrogen and soluble carbohydrate had to be synchronized. Contrary to these Adamu *et al*., (1995) reported that ammoniation and supplementation had no effect on dry matter digestibility but resulted in increased digestibility of NDF and ADF in sheep and that increase were not significant.

Animal fed WO had the highest N-intake (3.84g/day), this might be attributed to the protein content of the feedstuff, this finding corroborate Lamidi (2009) who reported higher N-intake for diet that had higher CP content. The higher N-faecal (1.12g/day) indicated that WO had larger endogenous and undigested CP. Also corroborate Alli-Balogun *et al*. (2003) and Ahamefule *et al*. (2007) who reported that N-faecal depends on the N-intake. Vas Soest (1982) stated that when the requirement of N is met, additional dietary N increases urinary N output. There was an observed similar in N loss in the urine of animals on the experimental treatments. Meanwhile, the experimental treatments promoted positive nitrogen balance with all the animals. The positive N-balance observed in all animals suggested that N absorbed was well tolerated and utilized by the animals as observed by Ahamefule *et al*. (2002).

CONCLUSION

Maize bran, wheat bran and wheat offal has a great potential in ruminant feeding especially goat, it can be feed without nutrient fortification with other feed stuff .Maize bran, rice bran and wheat offal stand a better chance for during dry season feed or when this animals were manage under tethering during cropping season without any adverse effects on the animals. Therefore, the feedstuff is hereby recommended for the production of goat.

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