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Research article

COMPARATIVE DIGESTIBILITY OF MAIZE STOVER, RICE STRAW, MALTED SORGHUM SPROUT IN WEST AFRICAN DWARF (WAD) SHEEP

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ABSTRACT: Three matured West African Dwarf sheep weighing between 19kg and 22kg were fed on three crop residues (rice straw, malted sorghum sprout and maize stover) for 14 days to estimate crude protein, ether extract, crude fibre, ash, acid detergent fibre (ADF) and neutral detergent fibre (NDF) and dry matter digestibility. Average daily feed intakes of the animals were 400g, 600g and 350g for diets A, B and C respectively, while water intake was 750, 680 and 730 ml/day in diets A, B and C respectively. The dry matter digestibility values are 2.4%, 13.4% and 1.9%, Crude protein digestibility are 35.8%, 31.3% and 13.5%, while crude fibre values are 10.0%, 28.2% and 28.7% in diets A, B and C respectively. The highest response of the animals in terms of digestibility of dry matter, ether extract and ADF was seen in malted sorghum sprout fed animal, while crude protein digestibility values was highest in rice straw. The result of these trial suggest that supplementation with malted sorghum sprout promote an encouraging performance in sheep in terms of dry matter and ADF digestibility, crude protein in rice straw, crude fibre ash and NDF in maize stover. However, crude fibre, Ash and NDF digestibility are better promoted in maize stover than in other feedstuff.
Key words: Digestibility, Maize stover, Rice straw, Sheep, Sorghum sprout

INTRODUCTION

Man in the tropics derives his protein mostly from plant sources such as legumes, oil seeds and pulses. Unfortunately, plant protein is not as balanced in their essential amino acids as animal protein. The ability of people to meet their dietary protein requirement has progressively declined due to rising loss of economic power to purchase animal protein sources. The low animal protein intake by Nigerians is a major concern among nutritionists. Hence technologies are been developed to enhance increased live-stock production [1]. The reason for the low consumption of meat and milk in the tropics could be as a result of the animal low productivity arising mainly from poor livestock management, poor genetic potential of indigenous animals, insufficient veterinary services, high cost of feed, drugs and low quality of available feed stuff. In view of this, a well planned food strategy will therefore increase protein availability in terms of increased quality and quantity of dietary protein [2,3,4,]. Attention has been directed towards the search for agro-industrial by-products and crop residue that have low inclusion rate in monogastric feeding formulation and which are not directly consumed by human beings but relished by ruminants, especially sheep with the aim of reducing scarcity of feed [5,6,7,8,9,10]. Sheep has the highest range of adaptation to maintain themselves in difficult or harsh environment and flexible interaction to dissimilar socio economic situations [11,12,] There are more than 118.5 million sheep in Sub-Saharan African out of which 22.1 million are found in Nigeria [13]. Most of the Nigerian sheep are found in the Sahel-Sudan zone. Sheep in Nigeria are kept primarily for meat. Sheep are very flexible with the kind of feed they feed on and it has been found that they can survive both on pasture herbage such as various species of grasses, legumes and herbs as well as concentrates [8,9]. They are also versatile to the extent that they can feed on most unimaginable feedstuff particularly plants and plant products of various sorts and various classes of dry forages, straws and chaff. Ruminants particularly sheep and goat play a key role in converting plant products human cannot or do not choose to consume into desirable high-quality animal protein [5,6].

Since much of the Earth's energy is stored in forms not readily edible to humans but which can be converted to human food by animals, thus effectively utilizing crop residues such as maize stover, rice straw and sorghum waste [6,7]. **In** ruminant, the dietary carbohydrate is converted to acetate in the rumen and the acetate is used to synthesize body fat [14]. Maize Stover is the stalk of maize plant and it is gotten in large quantities on maize plots that has been harvested and is used in ruminant production. Rice straw is the stem of rice plant. It is the remains of harvested rice farm and used in ruminant feeding. Malted Sorghum sprout is the by-product of sorghum processing and it is also used in ruminant feeding. Maize Stover, Rice straw, Poultry wastes, Wheat offals, and Malted Sorghum sprout have been extensively used in feeding live-stock (7,8,9,10) but their comparative digestibility's on small ruminants especially sheep have not been well documented.

In most farms and brewing industries, maize stover, rice straw, poultry wastes, rice bran and malted sorghum sprout (MSP) constitute nuisance on the farm and are burnt or left to decay thereby polluting the environment. If these crop residues and agro-industrial by-products are fed to animals, it reduces the cost of producing the animals and also yields some income to the farmer. This work therefore, assessed the comparative digestibilities of maize stover, rice straw and malted sorghum sprout by West African Dwarf sheep.

MATERIALS AND METHOD

Experimental Site

The experiment was carried out at the experimental station of the Small Ruminant Unit of the Teaching and Research Farm of the University of Agriculture, Abeokuta, Nigeria.

Pre-experimental Management of the Animal

The pen, metabolic cages, bowls and buckets were thoroughly washed and disinfected before the arrival of the animals. Three West African Dwarf sheep weighing between 19kg and 23kg were used for the experiment. Each animal was placed in a separate metabolic cage.

Experimental Diet Preparation

Three (3) experimental diets were prepared. The dried maize stover and rice straw were chopped into small sizes to reduce wastage, then salt was sprinkled lightly on it to facilitate intake by the animals because the sheep initially refused the diets. Salt was however not added to the malted sorghum sprout because it was better accepted by the animal than maize stover and rice straw.

Dietary Treatment

Each animal was assigned to one experimental diet and fed once daily in the morning. Each animal was supplied 4 litres of water daily. The animals were fed the different experimental feedstuffs for fourteen (14) days. There was seven (7) days period of acclimatization during which their intake was estimated and then adopted during the subsequent seven (7) days of digestibility study.

Data Collection

Faecal sample were collected daily for seven (7) consecutive days, bulked, air-dried, milled and a portion of it was kept for subsequent chemical analysis. Urine sample bottles were rinsed with dilute H_2S0_4 as preservative: Urine collection was also collected for seven (7) days, the volume measured and 10% sample preserved for analysis.

Chemical Analysis

The chemical analysis of faecal and feed samples for dry matter (DM), Ash, crude fibre (CF), crude protein (CP), nitrogen free extract (NFE), acid detergent fibre (ADF) and neutral detergent fibre (NDF) were carried out according to [15]. The gross energy of urine and urinary nitrogen were analyzed.

RESUL TS AND DISCUSSION

Table 1 presents the proximate components of the experimental feedstuffs. Rice straw had the highest DM (92.5%), followed by maize stover (91.0%) while MSP contain the least value (80.5%). The trend is reversed in the CP content in which case MSP contains 14.3%, followed by rice straw (8%) and maize stover the least (4.8%). The CF content indicates that maize stover contain the highest value (36.4%), followed by rice straw (30.4%) and MSP (18.8%). The MSP appears to be richest in EE (20.0%), followed by maize stover (11.0%) and rice straw the least (10.0%). The ash component in MSP is remarkably higher (22.0) than in rice straw (15.5%) and maize stover (6.5%). The ADF content is consistently lower than NDF content in all three feedstuffs.

Table1: Proximate composition of experimental feedstuff.

Parameter	Rice Straw	MSP	Maize Stover
Dry matter (%)	92.5	80.5	91.0
Crude protein (%)	8.6	14.3	4.8
Crude fibre (%)	30.4	18.8	36.4
Ether extract (%)	10.0	20.0	11.0
Ash (%}	15.5	22.0	6.5
ADF (%)	58.0	55.0	56.0
NDF (%)	68.0	62.0	72.0

Dry matter, crude protein, Ether extract, Ash, ADF, and NDF intake was highest in MSP while crude ,fibre was highest in maize stover. All nutrients intake were lowest in rice straw.

Table 2: Nutrient intake of experimental animals during digestibility

Parameter	Rice Straw	MSP	Maize Stover
DM Intake(g)	370	483	318.5
CP. Intake (g)	34.4	85.8	16.8
EE Intake (g)	40	120	38.5
Ash intake (g)	62	132	22.8
ADF Intake (g)	232	330	196
NDF Intake (g)	272	372	252

The proximate analysis of faecal and urine samples are recorded in **Table** 3, while Table 4 showed showing the variations with different feed stuff with respect to feed intake and water consumption. The value of average feed intake shows that MSP was consumed more than other feedstuff while water consumption was lowest in animal fed MSP. The faecal DM in rice straw and maize stover are quite close being 69.8% and 89.3%, respectively, while that of MSP is the lowest (69.8%). The trend is remarkably different in terms of CP content with MSP substantially higher (9.2%) than rice straw (5.1%) and maize stover (3.8%). The observation with CF shows that rice straw is highest (27.3%), followed by maize stover (26.0%) and MSP (13.5%), While the EE indicated 12.0% for MSP, 9.0% for maize straw and 7.0% for rice straw. The ash content also varies widely in the three feedstuffs with MSP containing the highest value (21.3%), followed by rice straw (14.7%) and maize straw (5.8%). The ADF contents of the feedstuffs are of close values, the NDF value follow similar trend but with slightly higher values than the ADF. The urinary nitrogen contents are approximately the same in all feedstuffs.

Table 3: Proximate analysis of faecal and urinary sample collected during digestibility trial.

	Rice Straw	MSP	Maize Stover
Faecal analysis			
Dry matter (%)	90.3	69.8	89.3
Crude protein (%)	5.1	9.2	3.8
Crude fibre (%)	27.3	13.5	26.0
Ether extract (%)	7.0	12.0	9.0
Ash{%)	14.7	21.3	5.8
ADF (%)	55.0	50.0	52.0
NDF (%)	60.0	52.0	58.0
Urine Analysis			
Urinary nitrogen (%)	0.059	0.099	0.054
Urinary crude protein (%)	0.37	0.62	0.34

In Table 4, values of average feed intake show that MSP was most consumed than other feedstuffs but least in water intake. However, it seems that more water is required when feeding animals on rice straw-based diets than MSP-based diet, while the difference in water requirements when either rice straw or maize stover is fed is not remarkable.

Table 4: The result of average feed intake and water **consumption**

Parameters/Treatments	Diet A Rice Straw	Diet B MSP	Diet C Maize Stover
Average feed intake(g/d)	400	600	350
Average water intake (ml/d)	750	680	730

Table 5 depicts the digestibility percentage of the different feedstuffs. The values for MSP in DM, CP, EE and ADF (13.4, 3l.3, 40.0 and 9.1 %) were higher than in others while the values for maize stover in CF, ash and NDF (28.7, 1l.5 and 19.44%) were higher than in others. It appears that rice straw was the least digested among the feedstuffs, because it has the least values in the entire nutrient digestibility considered.

Table 5: Digestibility estimation of maize stover, rice straw and malted sorghum sprout by the experimental sheep.

Parameter	Rice straw	MSP	Maize Stover
DM digestibility (%)	2.4	13.4	1.9
CP digestibility (%)	35.8	31.3	13.5
CF digestibility (%)	10.0	28.2	28.7
E.E digestibility (%)	30.0	40.0	18.0
Ash (%)	5.2	3.4	11.5
ADF digestibility (%)	5.2	9.1	7.1
NDF digestibility (%)	11.8	16.1	19.4

DISCUSSION

The proximate composition of the experimental feedstuffs depicts that only MSP (14.3% CP) could meet the crude protein requirements of small ruminants [16] while rice straw and maize stover would require additional crude protein resources to meet the 10-13% CP requirements in small ruminant [16]. However, aside from the crude protein, other nutrients seem adequate for any productive function in small ruminants [17]. The overall nutrient digestibility of the feedstuffs is below 50%. This supports the observation of [16] and [18] that crop residues are characterized by nutrient digestibility of below 50%. The higher dry matter digestibility of MSP than others suggests that MSP readily releases its nutrients for animal utilization than other experimental feedstuffs. This could be attributed to the fine nature of MSP. Also its fine nature could have facilitated easier digestive enzymes penetration into MSP for faster digestion. The significantly higher crude protein digestibility in the MSP than in others indicates that the nutrients are readily digested by digestive enzymes. While the lower crude protein digestibility in maize stover agrees with [19] that untreated cereal stover cannot maintain an animal when fed alone. The higher crude fibre digestibility in maize stover agrees with [20]) that in the utilization of high fibre forages as in maize straw, sheep is found better. The ADF of the three feedstuffs slightly vary. However, MSP had the highest ADF digestibility than others. High ADF digestibility stimulates the microbial optimum performance in the rumen of ruminants, [14]. This could also be responsible for the higher digestibility values of MSP with respect to other nutrients (DM, CP and EE) than rice straw and maize stover.

The NDF of the three feed stuff also vary slightly. They are all in line with the observation of [14] that higher NDF facilitates crude fibre digestibility.

CONCLUSION

From this study, it shows that Agricultural by-products and Agro industrial wastes had differences in their digestibility values while nutrients from the different feedstuff also vary in proportion. However, MSP seems to promote the highest digestibility of all the nutrients considered except CF, ash and NDF. It appears that the feedstuffs contain one nutrient or the other at a level recommended for ruminant animals for different level of productions.

However, no single feedstuff of the three can be recommended as a sole feed, but can be included in a compounded concentrate supplement. The main limitation in the use of MSP is its fine nature which causes diarrhea in the animal. Nevertheless, it can be incorporated at a level that will not pose any dietary problem in the animal. This calls for further research.

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