

## Intake, digestibility and nitrogen utilization of West African dwarf goats fed diets containing graded levels of alkaline treated malted sorghum sprout

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### Abstract

A twelve-week trial was conducted to determine the nutrients intake, digestibility and nitrogen utilization of West African dwarf (WAD) goats fed diets containing graded levels of alkaline treated malted sorghum sprout (AMSP) using *Panicum maximum* as the basal diet. A total number of sixteen (16) WAD goats with an average live weight;  $5.8 \pm 0.6$  kg were allotted on weight equalization into four (4) dietary treatments consisting of four goats per treatments in a completely randomized design. Four (4) diets were formulated to contain 0, 20, 40 and 60% AMSP. Data was collected on nutrients intake, digestibility and Nitrogen utilization parameters. Significant difference ( $P < 0.05$ ) were observed in all the nutrient intake parameters observed except for dry matter intake. Goats fed 40% AMSP recorded the highest total ash intake (27.01%), total acid detergent fibre (11.46%) and total cellulose intake (83.13%) compared with other dietary treatments. There was no significant difference ( $P > 0.05$ ) in all the nutrient digestibility parameters except the ether extract, ash, cellulose and hemicellulose. The highest Ash (66.16%), cellulose (82.47%) and hemicellulose (82.26%) contents were obtained in goats fed 40% AMSP. There were no significant differences ( $p > 0.05$ ) among the Nitrogen metabolism variables observed except total nitrogen intake and nitrogen balance. Goats fed 40% AMSP based diet recorded the highest Nitrogen retention (62.18%). It can therefore be concluded that 40% AMSP can be used as potential sources of supplements in ruminants feed most especially during dry season as it enhanced nutrient intake, digestibility and nitrogen balance.

**Keywords:** Nutrient, intake, Digestibility, Utilization, Alkaline, Malted Sorghum Sprout

### Introduction

Feed shortage especially during the dry season when pasture is of poor nutritive value has been identified as a major constraint to livestock (Ahamefule and Elendu, 2010). In Nigeria today, utilization of crop residues, agro-industrial by-products and non-conventional feed resources are still at infancy process because of great competition between human and livestock for the resources, and these have greatly reduced the animal protein intake. Malted sorghum sprout (MSP) as non-conventional feed resources has a lot of prospect as a feeding stuff for the livestock industry (Ologun *et al.*, 1998). MSP a by-product of sorghum malting is the separated root and shoots left after the malt extractions from the young germinating sorghum seedlings. (Aletor *et*

*al.*, 1998). It is rich in organic nitrogen (Ikediobi, 1989) and also contains 88.79% dry matter, 26.38% crude protein, 2.35% ether extract, 5.21% ash, 51.06% nitrogen free extract, 49.57% neutral detergent extract, 31.25% acid detergent fibre, 3.92% acid detergent lignin, 18.32% hemicellulose and 27.33% cellulose (Saka *et al.*, 2016). The anti-nutritional factors in MSP are tannin and hydrogen cyanide. Van Buren and Robinson (1969) reported that tannin influences the growth of animals in three main ways simply because they have astringent taste which affects palatability; decrease feed intake; form complexes with proteins thereby reducing its digestibility and finally act as an enzyme inactivators. More so, cyanide in MSP caused feed poisoning in animal (Wheeler, 1994). In order to improve the nutritional quality and

to provide effective utilization of MSP in ruminant, it is essential that anti-nutritional factors be removed or reduced. Detoxification by alkaline treatments might be a good means of reducing the level of anti-nutritional factors and possibly increase MSP nutritive values. Alkaline treatment is economical because it involves the use of wood ash being regarded as a waste. More so alkaline treatments of high fiber roughages have been investigated extensively, and there are numerous reviews of their effect in increasing feeding value for ruminants (Jakson 1978; Wanapat *et al.*, 1985). Thus the objective of this study is to determine the intake, digestibility and nitrogen utilization of West African dwarf (WAD) goats fed diets containing graded levels of Alkaline treated malted sorghum sprout.

## **Materials and methods**

### ***Site location***

The experiment was conducted at the Teaching and Research Farm of the Federal College of Animal Health and Production Technology, Moor Plantation, Ibadan in the South-western part of Nigeria. The area lies within the rain forest ecological zone, and falls within longitude and latitude  $7^{\circ} 27'$  and  $3^{\circ} 25'$  respectively at altitude 200-300m above the sea level with an annual rainfall of about 1250mm. The temperature and relative humidity ranges from  $30-35^{\circ}\text{C}$  and 76–84% respectively.

### ***Experimental animals and their management***

A total number of sixteen (16) West African dwarf (WAD) goats were purchased from a reputable farm in Oyo State with a pre-trial body weight of  $5.8 \text{ kg} \pm 0.6$  and they were housed intensively in an individual well ventilated pen. The pens were thoroughly washed and fumigated using (DD force) prior the arrival of the animals. On arrival,

the goats were quarantined for 30 days and during this period; they were given prophylactic treatments consisting of intramuscular injection of oxytetracycline long acting (1mL/10kgBW) and vitamin B complex to ensure good condition of the animals. They were also routinely dewormed with Albendazole and injected with ivermectin to eliminate both endo and ecto parasites respectively. Furthermore, the animals were vaccinated against PPR infection (*Pestis des petit ruminant*) and they were maintained on *Panicum maximum* and fresh cool clean water was supplied *ad libitum*. After the adaptation period, sixteen (16) WAD goats were balanced on weight equalization and allotted into four (4) dietary treatments consisting of four (4) goats per treatment. The diets as contained in (Table 1) for each treatment was fed with a basal diet of *Panicum maximum*.

### ***Source and processing of experimental diet***

The malted sorghum sprout (MSP) was purchased in dried form from Life care ventures limited, Sango Ota, Ogun State. The MSP used in this study was brown in colour. It was subjected to alkaline treatment according to the procedure of Fanimu and Akinola (2006) which involved the mixing 5kg of raw MSP with 300g of wood ash. The entire mixture was then mixed with 20 litres of water and left in a container for 72 hours (3 days) but with frequent stirring. On the 3<sup>rd</sup> day, the mixture was brought out of the container, the water was allowed to seep out after which it was sundried on the concrete floor. The sundried Alkaline treated MSP was then incorporated into the experimental diet at varying levels of 0, 20, 40 and 60% to formulate four dietary treatments as indicated in Table 1.

**Table 1: Gross composition of the experimental diet**

Ingredients	Inclusion Levels of AMSP			
	T <sub>1</sub> (0%)	T <sub>2</sub> (20%)	T <sub>3</sub> (40%)	T <sub>4</sub> (60%)
Maize	14.00	14.00	14.00	14.00
Maize bran	20.25	20.25	20.25	20.25
Wheat offal	60.00	40.00	20.00	-
AMSP	-	20.00	40.00	60.00
Premix	0.25	0.25	0.25	0.25
Limestone	5.00	5.00	5.00	5.00
Salt	0.50	0.50	0.50	0.50
Total	100.00	100.00	100.00	100.00
Calculated Analysis (%)				
Crude Protein	13.83	13.77	13.70	13.64
Crude Fibre	7.81	6.71	5.61	4.51
Metabolizable Energy (MJ/Kg)	8.82	7.40	5.97	4.55

**Experimental design**

A total of sixteen (16) West African dwarf goats (WAD) were randomly allotted into four dietary treatments consisting of four animals per treatment in a completely randomized design.

**Chemical analysis**

The Proximate and fibre fraction analysis of the experimental diets and faecal samples were determined according to the procedure described by AOAC (2001) and Van soest *et al.* (1991) respectively.

**Data collection**

Feed offered daily per animal were recorded and refusal were weighed and recorded to compute feed intake on daily basis. In short, voluntary intake was estimated as the difference between the feed offered and that consumed. The feed was offered at 5% body weight of the animals.

Dry Matter Intake ( $\text{gday}^{-1}$ ) = Feed intake on wet basis x DM of the feed/ 100

Nutrient Intake ( $\text{gday}^{-1}$ ) = Dry Matter Intake ( $\text{gday}^{-1}$ ) x Nutrient in feed/ 100

Nutrient in Feed was obtained from the proximate and fibre fractions analysis

**Digestibly test and nitrogen utilization study**

At the end of the feeding trial, two animals were randomly selected per treatment and transferred into individual metabolic cages for separate collections of urine and faeces.

Records of daily feed offered, feed refusals, faecal and urinary outputs were kept for seven (7) following 7 days of physiological adjustment to the cages. The faecal samples were collected each morning just before feeding. 10% of each daily faecal sample was collected daily and oven dried at 65°C from which sub-samples was bulked for chemical analyses such as proximate composition and fibre fractions. Voluntary intakes were estimated as the difference between the feed offered and feed consumed. Digestibility was determined by the method described by Mc Donald *et al.* (1987).

Apparent Digestibility (AD) of nutrients such as Dry matter, Crude protein, Ether extract, Ash, Acid detergent fibre, Acid detergent lignin and Neutral detergent fibre were calculated using the formula:

$$\frac{\text{Nutrient consumed (as feed)} - \text{Nutrient in faeces}}{\text{Nutrient consumed (as feed)}} \times 100$$

$$\frac{\text{Nutrient (Input - Output)}}{\text{Input}} \times 100$$

Daily urine samples from each goat were collected each morning just before feeding. The urine sample collected was released into a sample bottle containing 10mls of 10% concentrated sulphuric acid to prevent loss of Nitrogen and refrigerated until required for analysis. Nitrogen balance by goat was calculated as the difference between Nitrogen Intake and Nitrogen

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excreted from faeces and urine while Nitrogen utilization was calculated as  

$$NU = \frac{\text{Nutrient Retention}}{\text{Nutrient Intake}} \times 100$$

#### **Statistical analysis**

Data obtained were subjected to one-way analysis of variance (ANOVA) using (SAS, 2005). Significant means were separated using the Duncan multiple range test of the same software.

#### **Results**

Table 2 reveals the chemical composition of raw malted sorghum sprouts (RMSP) and alkaline treated malted sorghum sprout (AMSP). The dry matter and crude protein

values were higher in RMSP (79.20% and 27.55%) when compared with AMSP (66.44% and 20.40%). The ether extract value of RMSP (0.31%) reduced after processing to AMSP (0.21%). AMSP (11.25%) recorded higher ash content than RMSP (7.13%). The nitrogen free extract value observed in RMSP (36.11%) was higher than the value obtained in AMSP (15.71%). AMSP recorded the higher Neutral detergent fibre (55.00%), acid detergent fibre (38.00%), acid detergent lignin (25.00%) and cellulose (13.00%) values than RMSP while higher hemicelluloses values (35.05) were recorded for RMSP.

**Table 2: Chemical composition (%) of raw malted sorghum sprouts and alkaline treated malted sorghum sprouts**

Parameters (%)	RMSP	AMSP
Dry Matter	79.20	66.44
Crude Protein	27.55	20.40
Ether Extract	0.31	0.21
Ash	7.13	11.25
Nitrogen Free Extract	36.11	15.71
Neutral Detergent Fibre	53.00	55.00
Acid Detergent Fibre	18.00	38.00
Acid Detergent Lignin	10.00	25.00
Hemicellulose	35.00	17.00
Cellulose	8.00	13.00

Indicated in Table 3 is the chemical composition of the experimental diet. The dry matter value observed in this study decreased across the dietary treatments as the inclusion levels of alkaline treated malted sorghum sprout (AMSP) increased. The highest dry matter value was recorded in 0% AMSP (87.32%) while 60% AMSP had the lowest value (60.11%). The ether extract value was highest in 0% AMSP (2.58%) followed by 60% AMSP (1.30%), 40% AMSP (0.90%) and 20% AMSP (0.54%) respectively. 40% AMSP recorded the highest Ash content value (16.11%) and

the lowest value was recorded in 20% AMSP (8.61%). 20% AMSP based diet recorded the highest crude protein value (13.18%), Nitrogen free extract (51.32%), Neutral detergent fibre (75.00%) and Hemicelluloses (60.00%). The Acid detergent lignin value obtained in this study ranged from 0% AMSP (8.00%) to 60% AMSP (12.00%) while 20% AMSP and 40% AMSP recorded the same value (5.00%). The highest Cellulose value was recorded in 40% AMSP (28.00%) followed by 60% AMSP (14.00%), 0% AMSP (10.00%) and 20% AMSP (10.00%) respectively.

**Table 3: Chemical composition of the experimental diet**

Parameters	Inclusion levels of AMSP (%)			
	0%	20%	40%	60%
Dry matter	87.32	81.63	68.58	60.11
Crude protein	12.41	13.18	10.92	9.07
Ether extract	2.58	0.54	0.90	1.30
Ash	8.61	7.33	16.11	11.56
Nitrogen free extract	50.14	51.32	44.71	29.08
Neutral Detergent Fibre	65.00	75.00	72.00	52.00
Acid Detergent Fibre	18.00	15.00	33.00	26.00
Acid Detergent Lignin	8.00	5.00	5.00	12.00
Hemicellulose	47.00	60.00	39.00	26.00
Cellulose	10.00	10.00	28.00	14.00

AMSP: Alkaline Malted Sorghum Sprout

**Table 4: Nutrient intake of West African dwarf goats fed diet containing graded level of alkaline malted sorghum sprout**

Parameters (g/day)	Inclusion Level of AMSP				SEM±
	T <sub>1</sub> (0%)	T <sub>2</sub> (20%)	T <sub>3</sub> (40%)	T <sub>4</sub> (60%)	
<b>Dry Matter Intake</b>					
Concentrate	145.12	126.07	128.07	107.51	7.42
Forage	159.69	155.06	150.05	164.89	5.65
<b>Total</b>	304.80	281.13	278.12	272.40	10.79
<b>Crude Protein Intake</b>					
Concentrate	18.01 <sup>a</sup>	16.62 <sup>ab</sup>	13.99 <sup>ab</sup>	9.75 <sup>b</sup>	1.23
Forage	12.14	11.78	11.40	12.53	0.43
<b>Total</b>	30.14	28.40	23.02	24.27	1.36
<b>Ether Extract Intake</b>					
Concentrate	3.74 <sup>a</sup>	0.68 <sup>c</sup>	1.15 <sup>bc</sup>	1.40 <sup>b</sup>	0.37
Forage	2.76	2.68	2.59	2.85	0.10
<b>Total</b>	6.51 <sup>a</sup>	3.36 <sup>b</sup>	3.75 <sup>b</sup>	4.25 <sup>b</sup>	0.39
<b>Ash Intake</b>					
Concentrate	12.50 <sup>b</sup>	9.24 <sup>b</sup>	20.63 <sup>a</sup>	12.43 <sup>b</sup>	1.40
Forage	6.79	6.59	6.38	7.01	0.24
<b>Total</b>	19.28 <sup>b</sup>	15.83 <sup>b</sup>	27.01 <sup>a</sup>	19.44 <sup>b</sup>	1.44
<b>NDF Intake</b>					
Concentrate	94.33 <sup>a</sup>	94.55 <sup>a</sup>	92.21 <sup>a</sup>	55.90 <sup>b</sup>	6.67
Forage	120.96	117.46	113.66	124.90	4.28
<b>Total</b>	215.29	212.01	205.86	180.81	8.45
<b>ADL Intake</b>					
Concentrate	11.61 <sup>a</sup>	6.30 <sup>b</sup>	6.40 <sup>b</sup>	12.90 <sup>a</sup>	0.98
Forage	45.51	44.19	42.76	46.99	1.61
<b>Total</b>	57.12	50.49	49.17	59.89	2.23
<b>ADF Intake</b>					
Concentrate	3.24 <sup>b</sup>	2.49 <sup>b</sup>	4.62 <sup>a</sup>	2.54 <sup>b</sup>	0.30
Forage	7.28	7.07	6.84	7.52	0.26
<b>Total</b>	10.52	9.56	11.46	10.05	0.41
<b>Hemicellulose Intake</b>					
Concentrate	68.21 <sup>a</sup>	75.64 <sup>a</sup>	49.95 <sup>ab</sup>	27.95 <sup>b</sup>	6.49
Forage	25.07	24.34	23.56	25.89	0.89
<b>Total</b>	93.28 <sup>a</sup>	99.99 <sup>a</sup>	73.51 <sup>ab</sup>	53.84 <sup>b</sup>	6.64
<b>Cellulose Intake</b>					
Concentrate	14.51 <sup>b</sup>	12.61 <sup>b</sup>	35.86 <sup>a</sup>	15.05 <sup>b</sup>	2.99
Forage	50.30	48.84	47.27	51.94	1.78
<b>Total</b>	64.81 <sup>ab</sup>	61.45 <sup>b</sup>	83.13 <sup>a</sup>	66.99 <sup>ab</sup>	3.43

<sup>a,b</sup> Means within the same row with different Superscripts differ significantly (p< 0.05). AMSP: Alkaline Malted Sorghum Sprout, NDF: Neutral detergent fibre, ADL: Acid detergent lignin, ADF: Acid detergent fibre



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Presented in Table 4 is the nutrient intake of West African dwarf goats fed diet containing graded levels of AMSP. There was significant difference ( $p < 0.05$ ) in all the parameters observed except the dry matter intake. The total dry matter intake value observed in this study decreased across the dietary treatment as the AMSP inclusion level increased. The concentrate crude protein intake decreased across the dietary treatments as the inclusion levels of AMSP increased. Animals offered 40% AMSP had the highest ash intake both in concentrates and total while the least value was observed in goats fed 20% AMSP. The concentrate and total ether extract intake of animals fed AMSP based diet recorded lower values when compared with those on 0% AMSP. Animals fed 0%, 20%, 40% AMSP based diet recorded similar concentrate neutral detergent fibre intake values but higher than those fed 60% AMSP based diet. The concentrate acid

detergent lignin and acid detergent fibre intake observed in this study decreased and increased respectively across the dietary treatments up to those group fed 40% AMSP based diet. Goats fed 40% AMSP based diet recorded the highest total cellulose intake. Table 5 shows the nutrient digestibility of West African dwarf goats fed diet containing graded levels of Alkaline treated malted sorghum sprout. The nutrient digestibility values observed were not significantly ( $P > 0.05$ ) influenced by dietary treatments except the ether extract, ash, cellulose and hemicelluloses digestibility values. Animals fed 40% AMSP (66.16%) base diet recorded the highest Ash digestibility while the least value was obtained in goats fed 20% AMSP based diet. Animals fed 40% AMSP based diet had highest value in cellulose (82.47%) and hemicelluloses (82.26%) digestibility content.

**Table 5: Nutrient digestibility coefficient (%) of West African dwarf goat fed diet containing graded levels of alkaline treated malted sorghum sprout**

Parameters	Inclusion Levels of AMSP (%)				SEM
	0%	20%	40%	60%	
Dry Matter	76.58	76.14	78.90	78.63	1.11
Crude Protein	75.41	67.40	74.31	66.64	1.98
Ether Extract	90.11 <sup>a</sup>	75.44 <sup>b</sup>	85.09 <sup>a</sup>	82.48 <sup>ab</sup>	1.92
Ash	53.32 <sup>ab</sup>	37.36 <sup>c</sup>	66.16 <sup>a</sup>	50.54 <sup>ab</sup>	3.62
Neutral Detergent Fibre	76.02	75.51	77.47	78.35	1.13
Acid Detergent Fibre	49.29	46.58	65.58	54.06	3.40
Acid Detergent Lignin	66.16	72.99	74.47	79.48	3.35
Cellulose	79.09 <sup>a</sup>	77.14 <sup>ab</sup>	82.47 <sup>a</sup>	72.18 <sup>b</sup>	1.40
Hemicellulose	75.84 <sup>a</sup>	72.55 <sup>a</sup>	82.26 <sup>a</sup>	66.40 <sup>b</sup>	2.03

<sup>a,b</sup> Means within the same row with different Superscripts differ significantly ( $p < 0.05$ )

Indicated in Table 6 is the nitrogen metabolism of West African dwarf goats fed diets containing graded levels of alkaline treated malted sorghum sprout (AMSP). Dietary AMSP significantly influenced the nitrogen metabolism of goats observed in this study except the nitrogen intake and nitrogen balance were not significantly different ( $p > 0.05$ ) across the dietary treatments. Goats fed 20% AMSP recorded the highest faecal output (1.42g/day), followed by those that were

fed 0% AMSP and 60% AMSP (1.18g/day) that were statistically similar but significantly higher than goats in 40% AMSP (1.03 g/day). The urinary N- output was highest in goats fed 20% AMSP (0.74 g/day) while those in 40% AMSP recorded the lowest value (0.49g/day). The N-balance value obtained in this study ranged from 1.6-2.92 g/day. The highest percentage of nitrogen retention was recorded in goats fed 40% AMSP (62.18%) while goats fed 60% AMSP (46.12%) recorded the lowest value.

**Table 6: Nitrogen metabolism of West African dwarf goats fed Diet Containing graded levels of alkaline malted sorghum sprout**

Parameters	Inclusion levels of AMSP				
	0%	20%	40%	60%	SEM
Nitrogen (N) intake (g/day)	4.82	4.54	4.06	3.57	0.22
Faecal N- output (g/day)	1.18 <sup>ab</sup>	1.42 <sup>a</sup>	1.03 <sup>b</sup>	1.18 <sup>ab</sup>	0.06
Urinary N- output (g/day)	0.73 <sup>a</sup>	0.74 <sup>a</sup>	0.49 <sup>b</sup>	0.72 <sup>a</sup>	0.04
N-balance (g/day)	2.92	2.37	2.54	1.66	0.21
N-retention (%)	60.24 <sup>a</sup>	50.72 <sup>ab</sup>	62.18 <sup>a</sup>	46.12 <sup>b</sup>	2.59

<sup>a,b</sup> Means within the same row with different Superscripts differ significantly ( $p < 0.05$ ) N: Nitrogen, AMSP: Alkaline malted sorghum sprout.

## Discussion

The dry matter value of RMSP in this experiment (79.29%) was lower than the value (82.00%) of RMSP reported by Fanimó and Akinola (2006). The crude protein value of RMSP (27.55%) obtained in this study was higher than the value (22.60%) reported by Aning *et al.* (1998) but lower than the value (35.00%) reported by Ikediobi (1989). Alkaline treatment employed in this study reduced the crude protein content of MSP and brought about increase in their ash, NFE, NDF, ADF, ADL and cellulose content. The decrease in crude protein content of AMSP compared with RMSP was in accordance with what was reported by Saka *et al.* (2017) who studied the effect of different processing methods on the nutritive value of MSP. The dry matter (66.44%), ether extract (0.31%) and nitrogen free extract (15.71%) values of AMSP obtained in this study, was found to be lower than the values reported by Fanimó and Akinola (2006) for AMSP except crude protein (20.40%) and ash content (11.25%) which were higher than the values reported. The disparity observed in the chemical composition of MSP and AMSP might be attributed to the quality of the sorghum used to process the MSP and the varieties of sorghum used. Dry matter intake (DMI) is an important factor determining the utilization of feed in ruminants which simply referred to critical determinant of energy intake (Devendra, 1997). A non-significant dry matter intake values observed in this study showed that

the alkaline treatment employed was effective and efficient in reducing the bitterness that could have influenced the intake as it had been established by Morrison (1984) that MSP was somewhat bitter and unpalatable. The intake pattern of the supplements could be a reflection of the relative acceptability and palatability of these supplements. Masafu (2006) described feed intake as a measure of diet appreciation, selection and consumption by an animal. The result obtained from this study was in agreement with the result of Choi *et al.* (2005) who reported no significant differences in feed intake when Korean black goats consumed diets containing CP ranging from 12 to 18% CP. Generally, it is well known that feed intake increases with an increase in dietary CP level (Huston *et al.*, 1988; Cheema *et al.*, 1991) but here in this study the DMI was not affected but the concentrate crude protein intake decreased across the dietary treatments. The decrement observed in concentrate crude protein intake of the experimental goats across the dietary treatments could be attributed to the influence of alkaline treatment on MSP in reducing their crude protein content. This observation contradicted the study of Jia *et al.* (1995) an increase in DMI of goats fed higher dietary CP levels. However, this was in line with the observation of Hwangbo *et al.* (2009) that increasing or decreasing CP levels had no significant effect on DMI. The concentrate and total ether extract intake of the experimental goats decreased across the

dietary treatments as the inclusion levels of AMSP increased. This could be attributed to the effect of alkaline treatment on MSP reflecting on the experimental diets which eventually influenced the trend observed in ether extract intake. Goats fed 40% AMSP recorded the highest concentrate and total ash intake and this could be attributed to better absorption of nutrients. The concentrate NDF intake values obtained was similar in goats fed 0, 20, and 40% AMSP based diet but significantly higher than goats on 60% AMSP based diet group. The concentrate ADL and ADF intake values obtained in this study decreased and increased respectively across the dietary treatment up to those that were fed 40% AMSP based diet. It was evident from the results of this study that the processing method employed to reduce the anti-nutritional factors of MSP was effective and therefore enhanced the nutrient intake. Anti-nutritional factors have been reported to have detrimental effect on performance (Aganga and Adogla-Bessa, 1999). The apparent digestibility of dietary DM, CP, NDF, ADF, ADL levels were not significantly different between the treatments. The increase in ash and hemicelluloses digestibility values obtained across the dietary treatments up to those on 40% AMSP based diet group showed that the diets were palatable and digestible (McDonald *et al.*, 1995). This observation could be attributed to the fact that processing method employed to reduce the anti-nutritional factors of MSP was effective and therefore enhanced the nutrient digestibility of feed. This research work was in line with the result of Fajemisin *et al.* (2008) who also supported the fact that adequate nitrogen in all the diets enhanced the activities of rumen microbes which eventually improved the nutrients digestibility of the goats. The urinary N-output was highest in goats fed 20% AMSP (0.74g/day) while those fed 40% AMSP recorded the lowest value (0.49g/day). The

highest faecal N-output obtained in goats fed 20% AMSP could probably be due to the CP content in 20% AMSP that was not well utilized and thus was excreted. This was in conformity with the findings of (Kerchegessner *et al.*, 2001), who reported that nitrogen consumed in excess of animal requirement was excreted in urine and faeces. The higher urinary N-output observed in 20% AMSP compared to 40% AMSP. This could probably be due to a reflection of nitrogen in the rumen that depends on the quantity and solubility of the diets, which might have been lost from the rumen as ammonia and later converted to urea before being excreted as urine. This confirms the report of (Ahamefule and Udo, 2011) that nitrogen excreted in urine would depend on urea cycling and the efficiency of ammonia utilization produced in the rumen by microbes for microbial protein synthesis. The N-balance value obtained in this study ranged from 1.6g/day - 2.92g/day. The highest percentage of nitrogen retention was recorded in goats fed 40% AMSP (62.18%) while goats fed 60% AMSP (46.12%) recorded the lowest value. Nitrogen retention is the proportion of nitrogen utilized by farm animals from the total nitrogen intake for body process, hence the more the nitrogen consumed and digested, the more the nitrogen retained and vice versa, as observed by (Okeniyi *et al.*, 2010). This might also have been as a result of the amount of nitrogen used in protein deposition and nitrogen utilization in the rumen. This observation further buttressed the fact that the diet was well balanced in energy and protein which reduced nitrogen excretion in urine (Noblet and Van Milgen, 2004) therefore enhancing better nitrogen retention in goats fed 40% AMSP.

### **Conclusion**

Based on the result of this study, it can be concluded that alkaline treated malted sorghum sprout (AMSP) can be included up to 40% in feeding West African dwarf goats



most especially during dry season as it enhanced the nutrient intake, digestibility and nitrogen utilization.

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