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UTILISATION OF DIETS CONTAINING MALTED SORGHUM SPROUT (MSP) BY GROWING RABBITS

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ABSTRACT

A ten weeks study was conducted to evaluate the effect of feeding malted sorghum sprout (MSP) on the growth performance, nutrient utilization and blood chemistry of growing rabbits. Diets were formulated to include 0, 100, 200 and 300g/kg MSP levels. A total of thirty-two 7-8weeks mixed breed growing rabbits with weight ranging from 670-820g were used. The rabbits were assigned to four experimental groups on weight equalization basis. Each treatment group consisted of four replicates of two rabbits per replicate. The growth performance, utilization of various nutrient components and blood chemistry were measured. The final weight, daily weight gain, daily feed intake and daily protein intake decreased significantly ($P<0.05$) with increasing levels of MSP in the diets. Less ($P<0.05$) of the control diet (0% MSP diet) was consumed to produce a kg of rabbit meat. The dry matter, crude fibre and crude protein digestibility coefficients decreased significantly ($P<0.05$) with increased levels of MSP inclusion. The digestibility of dry matter, crude protein and energy were similar ($P>0.05$) up to 200g/kg MSP inclusion. The packed cell volume, haemoglobin and red blood cell decreased linearly ($P<0.05$) with increased MSP inclusion levels. However, white blood cell increased as MSP levels increased. The serum total protein, serum albumin and serum globulin decreased with increased levels of MSP. This study showed that MSP was poorly utilized by growing rabbits. Effecting treatments that can reduce antinutritional factors (ANFs) in MSP could improve its utilization by growing rabbits.

Key words: Malted Sorghum Sprout, antinutritional factors, growing rabbits

INTRODUCTION

In recent years, rabbit production has been on the increase both at household and commercial level in Nigeria. Rabbit's highly nutritious meat, versatile feeding habits, ease of handling and high rate of reproduction and growth and limited space requirement among other could be attributed to their increased production both at household and commercial levels. Although rabbits are herbivores for optimal performance particularly at commercial level, they need to be fed concentrate diets. The rapid increase in Nigerian population and the increasing intensive animal production has generated a stiff competition between man and animal for the limited concentrate feedstuff particularly energy sources like maize and protein sources like soybeans and groundnut. This development has led to astronomical increase in the cost of these feed increase ingredients and thus increased cost of production. The possible alternative is the use of cheap and locally available agro-industrial by-products and farm waste, among which is malted sorghum sprout (MSP).

Malted sorghum sprout is a by-product of malt processing companies. It is the dried roots and shoots left after extraction of malt from germinated sorghum (Ikediobi, 1989). MSP is being turned out in large quantity by the brewing industries and food confectioneries in Nigeria. MSP has a lot of prospects as feedstuff and it was reported to be rich in organic nitrogen and some amino acids (Ikediobi, 1989), though having low level of methionine and lysine (Taylor, 1993). Aning *et al.* (1998) reported that sorghum rootlets otherwise called malted sorghum sprout may be fed up to 40% level in the diet of rats. However, there is a dearth of information on the utilization of MSP by rabbits, which thus became the focus of the present study.

MATERIALS AND METHODS

Location of the Study

The experiment was carried out at the Livestock Teaching and Research Farms of the University of Agriculture, Abeokuta, Nigeria. Abeokuta (7^0 10^1 N and 3^0 2^1 E) city is 76m above sea level, humid and located in the tropical rain forest vegetation zone with an average daily temperature of 34.7^0C. The test ingredient (MSP) was obtained from a reputable malt processing company in Agbara, Ogun State, Nigeria. They were transferred to the feed mill and milled with other ingredients used in formulating the experimental diets.

Experimental Animal and Management

Thirty-two rabbits of mixed breeds and sexes purchased from a reputable rabbit farm in Abeokuta were used for this study. The rabbits were between 7-8 weeks of age and their weight ranged from 670-820g. On arrival at the rabbit unit, they were given antibiotics, mineral vitamin mix and dewormer. The rabbits were housed in wooden cages with metal mesh floors that allows for separate collection of urine and faeces. The cages were thoroughly disinfected before stocking. Each cage was provided with a concrete feeder and drinker. The house was designed to ensure cross ventilation and exclude rodents and other pests.

Experimental Design

Four practical experimental diets were formulated to contain 0, 100, 200 and 300g/kg MSP inclusion levels (Table 1). The levels of crude protein, energy and fibre were maintained to meet up with the recommended levels according to NRC (1994).

The rabbits were allotted to the four experimental diets on weight equalization basis in a complete randomized design. Each treatment group was subdivided into four 4 replicates with each replicate housing 2 rabbits. The feeding trial lasted for eight weeks.

Data Collection

Performance Characteristics

A known amount of feed was offered to the rabbits. Left over feed was weighed daily to determine intake. The rabbits were weighed on arrival at the farm while subsequent weighing was done weekly.

Metabolic Trial

A metabolic trial was carried out on the last week on the feeding trial. Four rabbits were selected from each treatment and transferred into metabolic cages equipped with facilities for separate collection of faeces and urine. The feed intake was measured while the faeces and urine voided were collected daily for three days after five days acclimatization to the metabolic cage. The faecal samples were weighed and representative samples were taken and oven dried at 65°C for 72 hours. The dried faecal samples were analyzed for proximate constituents (AOAC, 1995) and the digestibility of proximate constituents was calculated.

Blood Analysis

On the last day of the trial, 2.5ml blood was collected through neck slitting of two randomly selected rabbits in each treatment. The blood was collected into bottles containing ethylene diamine tetraacetate (EDTA) for haematological analysis. Another 2.5mls was collected in hypodermic syringe for the analysis of serum metabolites.

The chemical analyses of the feeds, faeces and MSP were done using the methods described by AOAC (1995).

The *haematological parameters*: Red Blood cell (RBC), Parked Cell Volume (PCV) and White Blood Cell (WBC) were determined using Wintrobe's microhaemtocrit as described by Baker and Silverton (1985). Total Serum Protein (TSP) was determined according to the methods of Colowich and Kolpan (1955), Serum Albumin was determined using bromocresol purple method (Varley *et al.*, 1980). Serum Creatinine was determined by Jaffe reaction as described by Bousness and Taussky (1945) and Serum Uric acid was determined according to the methods described by Wooton (1964). All data were analyzed using the Analysis of Variance procedure (Minitab, 2000) as complete randomized design. Significant means were separated using Duncan's multiple range test (Duncan, 1955).

RESULTS

Table 1 shows the chemical composition of the test diets containing (MSP) and of the MSP alone. MSP used in this study contained (gkg^{-1}) of crude protein (CP) 248.5, crude fibre (CF) 127.60, Dry matter (DM) 887.6, ash 25.60 and nitrogen free extract (NFE) 438.9. The presence of cyanide 53.5 and tannin 0.70gkg^{-1} is worthy of note. The proximate composition of the diets shows that they could adequately meet the requirement of growing rabbits.

Table 2 shows the performance of rabbits fed diets containing MSP. There were significant differences ($P<0.05$) among the diet group with regards to final body weight (FW) Daily feed intake (DFI), Daily weight gain (DWG), Daily Protein Intake (DPI) and Feed Conversion Ratio (FCR). The FW, DFI and DWG values were highest for rabbits fed control diet (0 gkg^{-1} MSP) were highest ($P<0.05$). There was no significant ($P>0.05$) difference between the DFI and DWG of rabbits fed 100 and 200gkg^{-1} MSP containing diets. The least value of these parameters was recorded for rabbits fed diets containing 300gkg^{-1} MSP. The feed conversion values increased as the MSP levels increased.

Table 3 shows the coefficient of nutrient digestibility of rabbits fed diets containing MSP. The DM digestibility decreased numerically with increased MSP level. The value recorded for rabbits fed 0, 100 and 200gkg^{-1} containing MSP were similar. The least ($P<0.05$) value was recorded for rabbits fed 300gkg^{-1} MSP level. The crude protein and crude fibre digestibilities followed a similar trend. Up to 200gkg^{-1} level of MSP inclusion, the values recorded for these parameters were similar ($P>0.05$). At 300gkg^{-1} level of MSP inclusion, the CP retention and CF digestibility dropped significantly. The digestibilities of ash and NFE were similar. Rabbits fed 0, 100 and 300gkg^{-1} MSP levels recorded statistically similar values for these parameters, while those fed on diets containing 200gkg^{-1} MSP recorded the least ($P<0.05$) value. The apparent energy digestibility coefficient was statistically similar in rabbits fed up to 200gkg^{-1} MSP inclusion. Rabbits fed 300gkg^{-1} MSP inclusion had the least ($P<0.05$) value.

Data on haematological parameters (Table 4) shows that PCV and Hb decreased ($P<0.05$) as the levels of MSP inclusion increased. RBC values were not different between the groups. The WBC increased with increased levels of MSP. Rabbits fed 200 and 300gkg^{-1} of MSP had a significantly ($P<0.05$) higher WBC values than those fed 0 and 100gkg^{-1} MSP. The serum total protein, albumin and globulin values indicated a significant decline at 200 and 300gkg^{-1} MSP inclusion.

DISCUSSION

The nutrient (proximate) compositions of the diets are adequate according to NRC 1994 recommended levels. The crude protein value of MSP (24.85) in this study is similar to the one reported (242.7gkg^{-1}) by Akinola (2002) but lower than 350gkg^{-1} reported by Ikediobi (1989). The difference in crude protein value could be due to varietal difference in sorghum used. The crude fibre obtained in this study (127.6gkg^{-1}) was higher than the value (80.0gkg^{-1}) reported by Oduguwa *et al.* (2001). The high crude fibre obtained in this study may have resulted from a longer time of germination of sorghum used. The roots and shoots may have undergone structural hardening. There were also the presence of cyanide (53.5g/kg) and tannin (0.7g/kg) in MSP. The linear reduction in final weight, daily feed intake, daily weight gain, daily protein intake and feed conversion ratio with inclusion of MSP in the diets may be due to the presence of cyanide and tannin in the feed. MSP is known to contain dhurrin, a glucoside which on hydrolysis yield equal quantity of hydrocyanide (Ikediobi, 1989; Taylor, 1993). Tannin is another ANFs known to be present in MSP (Aning *et al.*, 1998; Oduguwa *et al.*, 2001., Oduguwa *et al.*, 2005). Tannin are complex phenolic compounds with great structural diversity. The consumption of these ANFs has been reported to depressed net protein utilization and hence animal performance (Tewe and Pessu, 1980; Aletor, 1993; Aganga and Adolga-Bessa, 1999). The low intake of diets containing MSP suggests that MSP may not be palatable. Jegede (1999) attributed a low intake of MSP based diets fed to weanling rats to the bitter taste of MSP. This adds credence to the observation above. The trend for protein intake and protein efficiency ratio was largely similar and was in consonance with the observed performance parameters earlier discussed. The nutrient digestibility coefficient of rabbits fed MSP diets are slightly lower than non MSP control diet. This probably explains the depression in the performance of rabbits with increasing levels of MSP

The PCV and Hb of the rabbits depressed with increasing levels of inclusion of MSP. These indices are good indicators of nutrient availability (Ologhobo *et al.,* 1989).

This suggests that the quality of nutrients in MSP is poor. The elevation of the white blood cell with increased levels of MSP signaled the accumulation of foreign bodies or antinutritional factorss in the diets (Coles, 1997). The depression in the serum total protein, albumin and globulin with increasing levels of MSP seems to confirm that the depressed weight gain observed in this study was the result of poor utilization of the protein in the diets.

CONCLUSION

It can be concluded from this study that MSP is a novel feed resource; however its utilization by rabbits for growth is poor. It may be necessary to research the inclusion of enzymes or processing techniques that can drastically reduce the ANFs in MSP to improve its utilization.

Table 1: Gross composition and nutrient composition of experimental diets

Ingredients	Diets				
	1	2	3	4	MSP
Maize	480.00	475.00	450.00	410.00	
Soybean meal	185.00	165.00	140.00	110.00	
Wheat offal	300.00	225.00	175.00	145.00	
MSP	0.00	100.00	200.00	300.00	
Bone meal	20.00	20.00	20.00	20.00	
Oyster shell	10.00	10.00	10.00	10.00	
Salt	2.50	2.50	2.50	2.50	
Premix	2.50	2.50	2.50	2.50	
Total	**1000.00**	**1000.00**	**1000.00**	**1000.00**	
Determined Analysis					
Energy (ME kcal/g)	3.20	3.23	3.09	3.16	
Dry matter (gkg-1)	918.50	890.30	882.00	888.80	887.60
Crude protein (gkg-1)	178.50	180.30	182.00	183.80	248.50
Crude fibre (gkg-1)	102.80	103.90	108.30	112.60	127.60
Ether extract (gkg-1)	37.20	41.30	42.80	43.40	72.40
Ash (gkg-1)	102.70	107.60	108.10	112.40	25.60
Nitrogen free extract (gkg-1)	521.60	524.40	523.30	521.80	438.90
Hydrocyanide (gkg-1)	-	-	-	-	53.3
Tannin (gkg-1)	-	-	-	-	0.70

Table 2: Growth performance of rabbits fed diets containing varying levels of MSP

Parameters	Inclusion levels of MSP (gkg-1)			
	0	100	200	300
Initial weight (g)	687.50	681.15	670.00	681.80
Final weight (g)	1657.30a±55.6	1543.80b±3.6	1556.00b±119	1481.30c±54.1
Daily weight gain (g)	17.08a±1.22	15.40b±0.050	15.55b±1.66	14.38c±1.29
Daily feed intake (g)	78.50a±3.22	71.32b±0.30	72.26b±1.97	70.12c±4.33
Daily protein intake (g)	14.01a±0.94	12.86c±0.055	13.15ab±0.54	13.03bc±0.79
Feed conversion ratio	4.60c±0.81	4.63b±0.020	4.65b±0.53	4.87a±0.46
Protein efficiency ratio	1.22±0.098	1.24±0.0033	1.18±0.064	1.10±0.035

[abc] Mean values on the same row having different superscripts were significantly different (P<0.05)

Table 3: Digestibility coefficients of rabbits fed diets containing varying levels of MSP

Parameters	Inclusion levels of MSP (gkg-1))			
	0	100	200	300
Dry matter	0.76a±0.12	0.73a±0.11	0.74ab±0.058	0.67b±0.010
Crude fibre	0.68a±0.015	0.64ab±0.0059	0.61b±0.012	0.56c±0.0013
Crude protein	0.70a±0.017	0.68ab±0.0078	0.68ab±0.0067	0.65b±0.0088
Ash	0.79a±0.011	0.76a±0.0083	0.72b±0.00098	0.78a±0.0023
Ether extract	0.76a±0.0003	0.74b±0.0032	0.72c±0.0014	0.74b±0.0018
Nitrogen free extract	0.73a±0.014	0.70a±0.013	0.16b±0.00095	0.69a±0.0076
Apparent energy	0.72a±0.0067	0.71a±0.0051	0.71a±0.0034	0.69b±0.00078

[abc] Mean values on the same row having different superscripts were significantly different (P<0.05)

Table 4: Haematological and serum metabolites of rabbits fed diets containing varying levels of MSP

Parameters	Inclusion levels of MSP (gkg-1)			
	0	100	200	300
Haematological parameters				
Packed cell volume (%)	35.00a±0.63	32.50b±1.23	32.20b±3.14	29.50c±1.75
Haemoglobin (g/dl)	10.80a±1.22	9.70ab±0.75	9.30ab±0.05	8.50b±0.54
Red blood cell (x1012/l)	7.04±0.82	8.62±0.84	5.96±0.91	6.45±0.78
White blood cell (x109/l)	7.42b±0.12	9.06b±1.24	11.34a±0.54	11.80a±0.69
Serum metabolites				
Total serum protein (g/dl)	10.98a±0.94	9.68a±0.79	7.43ab±1.23	6.42b±1.20
Serum albumin (g/dl	3.84a±0.53	3.66a±0.72	2.74b±0.45	2.02b±0.23
Serum globulin (g/dl	7.14a±0.73	6.02a±0.81	4.69b±1.04	4.40b±0.66

[abc] Mean values on the same row having different superscripts were significantly different (P<0.05)

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