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Protein and energy value of maize and millet milling wastes for rabbits

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Abstract

Thirty-six mixed rabbits were utilized to determine the protein and energy value s of maize milling waste (MZMW) and millet waste (MLMW). Parts of these wastes were autoclaved (AMZMW and AMLMW) and also fed to test rabbits. There was a significant higher (P<0.05) feed intake by rabbits on the MLMW and AMLMW than on the MZMW and the AMZMW. The AMLMW gave the best net protein utilization of 44.21% which was comparable (P<0.05) with 34.79% obtained for the MLMW but significantly different (P<0.05) to 26.03 and 25.67% obtained respectively from AMZMW and MZMW. The biological values obtained are 41.48,53.00, 39.25, and 61.61% for MZMW, MLMW,AMZMW and AMLMW respectively. The autoclaved ingredients gave higher metabolizable energy of 15287.25 and 14832.00KJ for AMZMW and AMLMW respectively against 14620.75 and 13664.38KJ for MZMW and MLMW respectively.

Keywords: Rabbits, maize milling waste, millet milling waste, autoclaving; livestock feed.

Introduction

The high cost of animal protein and rapid increasing population in developing countries are the major constraints militating against the availability of the much-needed high quality protein food to low income people. An increase in the standard of living almost inevitably calls for an increase in availability of animal protein sources. This situation calls for the production of fast maturing animals like rabbits with the utilization of cheap and locally available feedstuffs, in order to produce them at an affordable cost.

There are reports that farm wastes such as kolanut pod (Oludokun and Olalokun, 199), cassava peels (Agunbiade *et al.*, 1999) and forages (Oduozo and Adegbola, 1992) could be efficiently utilized to produce meat.

Rabbits have been reported to survive successfully on diets based on roughages supplemented with agricultural by-products (Cheeke, 1983). This study was therefore aimed at determining the protein and energy values of maize and millet milling wastes for rabbits.

Materials and Methods

A total of 36, seven weeks old, male rabbit of mixed breed were used in the four weeks experiment. The proximate compositions of the test ingredients are presented in Table 1.

Table 1 *Proximate composition of test ingredients (dry matter basis)*

Proximate components	MZMW	MLMW	AMZMW	AMLMW
Dry matter	89.72	92.80	82.82	92.94
Crude protein	10.68	11.78	10.79	11.89
Ether extract	9.20	4.60	9.50	4.56
Crude fibre	5.68	5.00	5.50	5.15
Ash	4.40	4.30	4.37	4.52
Gross energy KJ/Kg	18667.00	18053.00	19181.50	18838.90

Part of the maize milling waste (MZMW) and millet milling waste (MLMW) were autoclaved (121°C and pressure of 100 x 103 NM^{-2}) for 25 minutes. There were four experimental diets Table 2 with 3 replicates per treatment and 3 rabbits per replicate.

Table 2 *Composition of experimental diets (Kg/100Kg)*

Ingredients	MZMW	MLMW	AMZMW	AMLMW
MZMW	97.50	0.00	0.00	0.00
MLMW	0.00	97.50	0.00	0.00
AMZMW	0.00	0.00	97.50	0.00
AMLMW	0.00	0.00	0.00	97.50
Salt	0.50	0.50	0.50	0.50
Limestone	1.00	1.00	1.00	1.00
Vit-mineral premix*	0.90	0.90	0.90	0.90
CuSO4 – 5H2O	0.10	0.10	0.10	0.10
Total	**100.00**	**100.00**	**100.00**	**100.00**
Proximate analysis(% Dry matter basis)				
Crude protein	10.63	11.74	10.74	11.82
Ether extract	9.97	4.37	9.39	4.64
Crude fibre	5.67	5.20	5.65	4.90
Ash	4.75	4.65	4.80	5.55
Gross energy KJ/Kg	18659.00	18052.70	19162.30	18836.30

*The vitamin-mineral premix used contain the following per kg: Vitamin A 71,500IU; Vitamin D_3, 14, 500IU; Vitamin E,31, 680IU; Vitamin K, 0.749g; Vitamin B_3, Vitamin B_2, 3600g; Vitamin B_6, 7.15g; Vitamin B_{12}, 50g; Calcium Pantothenate 52.90g; Niacinamide, 179g; Manganese, 10g, Zinc, 4.50g; Copper 0.20g, Iron, 5.00g; Iodine, 0.15g; Cobalt 0.02g and Selenium 0.01g.

The animals were housed in metabolic cages designed for easy collection of urine and faeces. Feed and water were supplied *ad libitum.* Diets were given in mash form at ratio 2:1 (2 of feed to 1 of water, w/w) to prevent dustiness. The rabbits were acclimatized to the cages for 3 weeks during which standard grower mash was given. The experimental period consisted of seven days adjustment to the experimental diets followed by a four day faecal and urine collection, chromic oxide was used as a maker for the onset and end of collection (Fraichney, 1980). Daily record of feed intake, faecal and urine output were kept. The faecal samples collected were oven dried at 70°C for 24 hours, they were weighed and stored in polythene bags and kept at – 4°C in freezer. The urine was collected in vessels containing 5ml of 0.05M hydrochloric acid as preservative. The total volume voided on daily basis recorded and 5% aliquot was accumulated and stored in the freezer pending analysis. All proximate analysis (feeds and faeces) were carried out by the method of A.O.A.C. (1980) and data were subjected to the completely randomized block design and were statistical significance were observed, the means were compared using Duncan's multiple range test (Steel and Torrie, 1980). The protein and energy value of test ingredients were calculated using methods by Crampton and Harris, (1969).

Results

Nitrogen balance results are presented in Table 3. the dry matter intakes by rabbits on all test diets were comparable ($P>0.05$). But the intake by rabbits on MLMW and AMLMW "seems" higher than those on the MZMW and AMZMW diets. The nitrogen intake by test rabbits were significantly higher ($P>0.05$) on the MLMW and AMZMW diets (0.492 and 0.489g respectively) than those on the MZMW and AMZMW diets with 0.287 and 0.328g respectively. The faecal nitrogen value for MZMW and MLMW were significantly ($P<0.05$) different from one another but both were comparable ($P>0.05$) to the values recorded for AMZMW and AMLMW. The values of urinary nitrogen were comparable for all the diets.

Table 3 *Nitrogen balance values of rabbits fed milling wastes*

Parameter	MZMW	MLMW	AMZMW	AMLMW	SEM
Dry matter intake(g)	18.84 $\pm$ 3.94	28.27 $\pm$ 4.08	21.32 $\pm$ 6.58	28.02 $\pm$ 8.01	4.001
Nitrogen intake (g)	0.29 $\pm$ 0.06^b	0.49 $\pm$ 0.07^a	0.33 $\pm$ 0.10^b	0.49 $\pm$ 0.14^a	0.065
Faecal nitrogen (g)	0.09 $\pm$ 0.03^b	0.17 $\pm$ 0.07^a	0.11 $\pm$ 0.07^{ab}	0.15 $\pm$ 0.05^{ab}	0.045
Urinary nitrogen (g)	0.12 $\pm$ 0.05	0.02 $\pm$ 0.06	0.15 $\pm$ 0.060	0.13 $\pm$ 0.05	0.041
Absorbed nitrogen (g)	0.19 $\pm$ 0.05^b	0.33 $\pm$ 0.06^a	0.22 $\pm$ 0.9^b	0.03 $\pm$ 0.12^a	0.058
Retained nitrogen (g)	0.08 $\pm$ 0.05^b	0.17 $\pm$ 0.03^a	0.08 $\pm$ 0.08^b	0.22 $\pm$ 0.101^a	0.052
Digestible crude Protein (g)	7.62 $\pm$ 1.119	8.22 $\pm$ 1.164	7.38 $\pm$ 1.307	8.11 $\pm$ 1.336	0.975
Net protein Utilization (%)	25.67 $\pm$ 14.37^b	34.79 $\pm$ 10.15^{ab}	26.03 $\pm$ 17.28^b	44.21 $\pm$ 9.05^a	10.371
Biological value %	41.48 $\pm$ 18.55	53.00 $\pm$ 9.90	39.25 $\pm$ 27.37	61.61 $\pm$ 15.42	15.284

Means in the same row with different superscripts differ significantly ($P<0.05$).

More (P<0.05) nitrogen was absorbed and retained by rabbits on MLMW and AMLMW than those on MZMW and AMZMW diets. The MLMW and AMLMW tended to have numerical higher (P>0.05) digestible protein than MZMW and AMZMW. The rabbits utilized more (P<0.05) of the protein from AMLMW (44.21%) than the protein from other diets, except for MLMW which had a fairly comparable value (34.70%). There was no significant difference in the biological values of the four feed ingredients, however the biological values of MLMW and AMLMW (53.00 and 61.6% respectively) tended to be higher than those of MZMW and AMZMW (41.48 and 39.25%) respectively.

The results of the energy values are presented in Table 4. the gross energy intake was significantly different for the feedstuffs, the urinary and faecal energy values for the treatments were comparable (P>0.05). the results of MLMW and AMLMW had higher (P<0.05) absorbed and retained energy values than those on maize milling waste based diets except for the AMZMW that's comparable to the MLMW values. The energy digestibility (%) and metabolizable energy (%) were all comparable (P>0.05) of the treatments AMZMW and AMLMW had higher (P<0.05) metabolizable energy values than the un-autoclaved feedstuffs except for the MZMW with a comparable value (P>0.0%).

Table 4 *Energy values of rabbits fed milling wastes*

Parameter	MZMW	MLMW	AMZMW	AMLMW	SEM
Gross energy intake (g)	374.36 $\pm$ 52^{b}	510.33 $\pm$ 3.64^{a}	408.58 $\pm$ 126^{b}	546 $\pm$ 155^{b}	75.045
Urinary energy (KJ)	14.62 $\pm$ 9.07	21.84 $\pm$ 14.47	14.92 $\pm$ 10.18	16.61 $\pm$ 13.90	9.643
Faecal energy (KJ)	65.30 $\pm$ 23.87	86.61 $\pm$ 33.34	90.24 $\pm$ 54.14	93 $\pm$ 26.41	30.30
Absorbed energy (KJ)	288.64 $\pm$ 57.5^{c}	407.8 $\pm$ 60.677^{ab}	334.52 $\pm$ 106^{bc}	449.77 $\pm$ 57^{a}	21.427
Retained energy (KJ)	273.94 $\pm$ 52.76^{c}	385.8 $\pm$ 54.32^{ab}	319.59 $\pm$ 104.93^{bc}	433 $\pm$ 134.75^{a}	56.282
Digestible energy (KJ)	15386.13 $\pm$ 844^{a}	14423.0 $\pm$ 666^{ab}	13739.5 $\pm$ 1622.2^{b}	15487 $\pm$ 666^{a}	743.864
Energy digestibility(%)	81.80 $\pm$ 4.49	79.89 $\pm$ 3.69	82.14 $\pm$ 8.47	82.25 $\pm$ 3.58	3.824
Metabolizability of energy (%)	77.73 $\pm$ 4.89	75.69 $\pm$ 4.06	78.47 $\pm$ 10.01	79.14 $\pm$ 3.58	4.487
Metabolizable energy intake (KJ)	14629 $\pm$ 896^{ab}	13664.38 $\pm$ 733^{b}	15287.25 $\pm$ 1913^{a}	14832 $\pm$ 680^{a}	877.420

Means in the same row with different superscripts differ significantly (P<0.05).

Discussion

The low feed intake observed on the MZMW and AMZMW diets could be associated with the higher energy content of these feedstuffs compared with the lower values of MLMW and AMLMW. Animal are known to eat to meet their energy needs (Hill and Dansky, 1954). The feed intake which was improved in the AMZMW as against the MZMW agrees with the findings of Murillo *et al.*,(1983) that increased feed intake, growth rate, and feed conversion efficiency were observed when broilers were fed autoclaved feedstuff. The better net protein utilization and biological value obtained on AMLMW as against MLMW might be that in the course of autoclaving some of its prolamin fractions were destroyed. Oko *et al*,.(1985) reported that most cereal grains of the tropics have low biological value due to deficiency of lysine and tryptophan and pearl millet in particular due to high levels of prolamin fractions. These deficiencies might also be responsible for the low biological values obtained for the tested feedstuffs. The higher metabolizable energy values obtained for MZMW and AMZMW could be because of their oil content as seen from their ether extract values. Surprisingly, the AMLMW has numerically higher metabolizable energy value than even MZMW despite its lower ether extract value.

The tested feedstuffs even have higher metabolizable values than 12602.22KJ/kg reported for rice bran (Kratzer and Payne, 1977). Utilization of these ingredients with high energy values in the diets of rabbits which was put at 1543.144KJ/kg (Cheeke, 1986) may be advantageous. These wastes should not be discarded but their utilization in the diets of rabbits will go a long way in reducing their cost of production. Milling wastes have been reported to be relatively cheap compared to whole grains (Atteh *et al.,* 1993). The energy content of these wastes have been reported to be low compared to the whole grains (Longe and Adetola, 1977). But the act of autoclaving these wastes have not improved both their protein and energy values, except for the metabolizable energy value, of the millet milling waste. Hence, autoclaving is not recommended because it will also lead to increase cost of (production) these wastes.

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