Agrosearch Vol 4, Nos 1 & 2, 1998 pp 1 - 11

REPLACEMENT VALUE OF MILLET WASTE FOR MAIZE ON THE PERFORMANCE OF GROWING RABBITS IN THE SUDAN SAHELIAN ZONE OF NIGERIA.

J.U. Igwebuike; N. K. Alade and Aliyu, J.
Department of Animal Science,
University of Maiduguri,
P.M.B. 1069, Maiduguri,
Nigeria.

ABSTRACT

The study, which lasted 56 days, was designed to investigate the effect of replacing maize with millet waste (MW) on the performance of growing rabbits. MW replaced equivalent levels of maize at 0,10,20 and 30% levels in diets 1 (control), 2, 3 and 4 respectively. The crude protein of the diets was approximately 19%. Twenty-four rabbits of mixed breed and sexes, aged between 5 and 7 weeks, were used for the study. They were individually weighed, matched for weight and randomly assigned to the four diets (treatments) in groups of six but caged individually. The diets, in mash form, and clean drinking water were supplied to the rabbits *ad libitum*. The feed intake (FI), average daily gain (ADG), feed conversion ratio (FCR) and mineral availability constituted the major response criteria. The FI, ADG and FCR were not significantly ($P>0.05$) affected by the various dietary levels of MW. Apparent availability of some minerals (P, K, Mg and Na) were significantly ($P<0.05$) depressed at 30% levels of MW. Calcium (Ca) availability increased ($P<0.05$) at 20 and 30% levels of MW. Furthermore, the incorporation of MW at the levels studied resulted in reduced feed cost and lowered feed cost per kg gain. The results of this study suggest that 30% of MW could be included in the diets of growing rabbits without adverse effects on performance. However, further study is needed to test the efficacy of higher levels of MW in the diets of growing rabbits.

Key words: Millet waste, growing rabbits, performance, mineral availability

INTRODUCTION

The processing of cereal grains for human use generates a lot of waste (residues) quite commonly used for ruminant feeding. In the semi-arid areas, these serve as good supplementary feeds for ruminants during the dry season when good quality roughages are scarce. However, their use in the diets of monogastrics is quite restricted due to their high fibre content. Rabbits, being non-ruminant herbivores appear to require relatively higher dietary fibre level in their diets than most monogastrics (Lang, 1981). Santoma et al. (1989) reported that rabbits can achieve high levels of

performance on fibrous diets as a result of their peculiar digestive physiology. This tolerance to high fibre level is attributed to ceacal fermentation and ceacotrophy (Raharjo et al., 1988). The apparent satisfactory performance of rabbits on diets compounded with materials hitherto regarded as waste (Ikurior and Kayode, 1995), therefore calls for diligent evaluation of these unconventional feed ingredients.

One of such unconventional feedstuffs is millet waste (MW), a by-product arising from the processing of millet grain (*Pennisetum typhoideum*) into a local beverage drink (Kunu Zaki). The processing method involves mild fermentation (12 hours) and thorough grinding which have been shown to improve the utilization of high fibre feeds by rabbits (Laplace and Lebas, 1977; Uchida et al., 1983; Cheeke, 1987; Adegbola and Oduoza, 1992).

The present study was designed to investigate the effect of various dietary levels of dried milled waste (MW) on the performance and mineral availability to young growing rabbits in the Sudan Sahelian zone of Nigeria.

METHODOLOGY

Site of the Experiment

The experiment was conducted at the Teaching and Research Livestock farm of the Animal Science Department, University of Maiduguri, Maiduguri, Nigeria. Maiduguri lies within the Sahelian zone of the country. The area is usually characterized by short periods (3 to 4 months) of rainfall and a very long dry season (8 to 9 months); ambient temperature is about 31°C by August but can be as high as 40° or more by April – May. The relative humidity fluctuates between 5% (December – January) to 45% in August (Alaku and Moruppa, 1988).

Experimental Stock and Management

Twenty-four rabbits obtained from small-scale farmers within Maiduguri metropolis were used for the study, which lasted 56 days. They were of mixed breeds and sexes, aged between 5 and 7 weeks at the inception of the experiment. The rabbits were matched for weight and assigned to the four treatments in groups of 6 (4 males and 2 females).

The rabbits were individually housed in cages measuring 33 x 38 x 45cm. Each cage unit was equipped with feeding and drinking troughs, and fine wire mesh underneath to trap the faeces. The feed, in mash form, and clean drinking water were provided *ad libitum*. The watering troughs and floor of the pens were cleaned daily.

Experimental Diets (Treatments):

The composition and the chemical analysis of the four experimental diets are shown in Tables 1 and 2 respectively. Millet waste (MW) was incorporated into diets 1, 2, 3 and 4 at 0, 10, 20 and 30% levels respectively. Maize was replaced by MW on equivalent levels/weight

basis. The protein content of the diets was maintained at about 19%.

Origin of the Millet Waste (MW):

Millet waste (MW) is a by-product obtained from the processing of grain millet (*Pennisetum typhoideum*) into porridge or a local beverage drink ('Kunu Zaki'). It involves soaking of clean winnowed grains in cold water overnight or in a hot water for 3 to 4 hours. After soaking, the grains are removed from the water, ground to a pasty consistency, mixed with water and sieved with a nylon cloth with pores. The residue thus collected in the sieve is the MW. It is then sun-dried for 5 days to obtain the product normally fed to animals directly or incorporated into diets.

The proximate composition of the MW used for this study is shown in Table 2.

Data Collection/Parameters measured

Feed intake was recorded daily while the animals were weighed weekly to determine weight gain. The average daily gain and feed efficiency were computed.

Faecal Collection

All the 6 rabbits per treatment were used for the determination of the apparent availability of the minerals (Ca, P, K, Mg and Na). The faecal collection was done for a period of 7 days during week 8 of the experiment. The fresh faeces were collected with fine wire mesh placed 10cm below the cages. The faeces excreted daily were weighed and oven-dried at 100°C for 24 hours. The dry faeces from each rabbit were bulked, milled and stored for chemical analysis.

Mortality

All deaths that occurred during the period of the study were recorded and probable cause of death determined by post-mortem examination.

Chemical Analysis

The dry matter (MW) contents of the samples (feed, faeces and MW) were determined by drying at 100°C for 24 hours. The ash content was obtained by ashing samples in an electric furnace at 550° for 12 hours. The crude protein (CP), ether extract (EE) and crude fibre (CF) were determined according to the standard AOAC (1984) methods of analysis. The nitrogen free extract (NFE) was obtained by differences while the minerals were determined by atomic absorption spectrophotometry and flame photometry after wet digestion of the samples with a mixture of concentrated nitric and perchloric acids.

Statistical Analysis

Data obtained were subjected to analysis of variance (ANOVA) using the completely randomized block design as described by Steel and Torrie (1980). Where significant differences ($P<0.05$) were observed means were compared using the least significant difference (LSD).

RESULTS AND DISCUSSION

Feed Intake (FI)

The data on feed intake, liveweight gain, feed conversion and mortality are presented in Table 3. The lowest (62.16g) and the highest (63.71g) feed intakes were recorded in treatments 1 and 4 respectively. Although, it appears that the rabbits consume more feed as the level of MW increases, these differences were not significant (P>0.05). The daily feed intake recorded (62.16 – 63.71g) compares favourably with the figures (55 – 69g) reported by Adegbola and Akinwade (1981) but is lower than the daily FI of 79g reported by Rastogi (1989) for rabbits of similar ages fed pelleted concentrate diets. The differences observed here may be attributed to the physical form of the diets (mash Vs pellets). Rabbits are known to consume more feed in the form of pellets than mash (Lebas, 1973; King, 1974; Grobner et al., 1983).

The average dry matter feed intake (DMI) expressed as percentage of mean final liveweight were 3.96, 4.10, 4.16 and 4.2% for rabbits on diets 1, 2, 3 and 4 respectively. These may be inadequate for optimum performance since these values were below the range of 4.5 to 7% (Joyce et al., 1971; Aghina and Ladetto, 1973) recommended as the ideal.

Average daily gain (ADG).

All rabbits in the various treatments showed positive weight gain (Table 3) ranging from 9.10 to 10.64/rabbit/day. Rabbits on diets 1 and 4 recorded the highest and lowest weight gain respectively. The result showed a slight decrease in gain with increasing levels of MW. However, these differences were not significant (P>0.05). This observation agrees with those of Harris et al. (1983) and Aduku et al. (1988) who reported that weight gain was similar on diets containing high (34.89% CF) or low (14.84% CF) fibre levels.

The ADG (9.10 to 10.64g/d) obtained in this study was lower than the 12g/day recorded by Ekpenyong (1984) and 18.2 – 19.3g/day recorded by Aduku et al. (1988) for rabbits reared under tropical conditions. The weight gains were also lower than the 25 to 50 g/day reported for temperate rabbits (de Blas and Garvey, 1975; Reddy et al., 1977). The differences may be due to the breed and environmental factors. Ekpenyong (1984) and Aduku et al. (1988) used New Zealand white rabbits while the Dutch or their crosses with other breeds were used for this study. Gillespie (1992) observed that New Zealand white rabbits have faster growth and rate of gain than most other breeds. Cheeke (1987) also reported that rabbits of temperate origin have faster rate of gain than their tropical counterparts.

Feed Conversion Ration (FCR)

The FCR (Table 3) was similar (P>0.05) in all the treatments. The value obtained here compare favourably with the 6.4 – 8.7 and 5.7 to 9.44 reported by Alawa et al. (1990) and Abu and Ekpenyong (1993) respectively. Conversely, this is inferior to the value (3.6) reported

by Rastogi (1989) for rabbits fed pelleted concentrates. Pelleting has been recommended as a way of minimizing selective feeding and consequent wastage of feed (Lang, 1981; Cheeke, 1979).

The poor FCR of rabbits on unpelleted diets may be explained by a disturbance of the normal rhythm of feed intake and excretion (Lebas and Laplace, 1977). These authors reported that rabbits spend more time eating, when diet is presented in meal form and exhibit a change in the pattern of excretion, which reduces the FCR.

Mortality

One death each was recorded in treatments 2 and 3. The death in treatment 2 was attributed to pneumonia while the mortality in treatment 3 was due to pasteurollosis infection. None of the deaths was attributed to the diets.

Mineral availability:

Results of the apparent mineral availability are shown in Table 4. Significant ($P<0.05$) depression in the utilization of potassium (K), magnesium (Mg), phosphorus (P) and Sodium (Na) were observed in treatment 4. No differences were noticed in treatments 1, 2 and 3. The low availability of these minerals at 30% MW may be attributed to the crude fibre (CF) level of the diet. The level of fibre increased with increasing levels of MW, with treatment 4 having the highest CF level of 14.09%. The depressing action of fibre on mineral availability to poultry was previously reported by Nwokolo and Bragg (1977) and Nwokolo et al. (1985). In this study, the depressing effect was only obvious at 30% level of MW.

Conversely, marked absorption of Calcium (Ca) was observed in treatments 3 and 4. This may be as a result of the unusual metabolism of Ca in rabbits as reported by Lang (1981); the serum Ca levels reflect dietary intake (Chapin and Smith, 1967; Cheeke, 1976) unlike in other species. Homeostasis of blood Ca by calcitonin and Parathormone does not take place (Lang, 1981). Probably the higher levels of Ca in diets 3 and 4 (Table 2) may be responsible for the higher intake and hence better apparent utilization of Ca by rabbits on the two diets (3 and 4).

Economic Performance

The economic analysis of the experimental diets is presented in Table 5. The feed cost per Kg decreased with increasing levels of MW. The highest (₦4.68) and lowest (₦2.95) cost per Kg feed were obtained from diets 1 and 4 respectively. Although the control (treatment 1) recorded the lowest total feed intake (3480.96g/rabbit) and the highest total weight gain (596.0g), the group has the highest total feed cost per Kg gain (₦27.33 compared to ₦26.63, ₦22.58 and ₦20.65 for diets 2, 3 and 4 respectively). This indicates that these diets (2, 3 and 4) are more economical in supporting growth than the control.

The economic benefit obtained in this study was due to the price differential between maize and MW. At the time (1996) this study was conducted the prevailing market prices were N6.50 and N0.90 per Kg of maize and MW respectively. Therefore, the incorporation of MW into the diets of growing rabbits led to a considerable reduction in feed cost.

CONCLUSION

It may be concluded from this study that up to 30% of MW could be incorporated into the diets of young growing rabbits without a significant decline in performance. In view of the cheaper cost of procuring MW, more study is needed to test the effects of higher levels of MW on the growth and general performance of growing rabbits.

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Table 1: Composition of the experimental Diets.

Ingredients	Diets/Treatments 1(control)	2	3	4
Yellow maize	41.58	31.58	21.58	11.58
Wheat offal	23.10	23.10	23.10	23.10
Millet waste	0	10.00	20.00	30.00
G/nut haulm	19.00	19.00	20.00	20.42
Cotton Seed meal	9.42	9.42	8.32	8.00
Fish meal	5.00	5.00	5.00	5.00
Bone meal	1.50	1.50	1.50	1.50
Salt (NaCl)	0.25	0.25	0.25	0.25
Premix*	0.15	0.15	0.15	0.15
Total	100.00	100.00	100.00	100.00

*Premix manufactured by Pfizer Nig. PLC supplying the following per kg: vitamin A, 71,500.00 IU; Vitamin D_3, 14,500.00 IU; Vitamin E, 31,680.00 IU; Vitamin K (activity), 0.749g; Vitamin B_1, 50g, Vitamin B_2 36.00g, Vitamin B_{6}, 7.15g; Vitamin B_{12}, 50mg; Calcium Pantothenate, 52.90g; Niacinamide, 179.00

Table 2: Chemical composition (DM Basis) of the experimental diets and millet waste (MW).

Constituents (%)	Diets/Treatments 1(Control)	2	3	4	MW
Dry matter (DM)	91.74	91.34	92.36	90.76	89.50
Crude protein (CP)	18.91	19.08	19.29	19.43	16.00
Crude fibre (CF)	12.42	12.59	12.62	14.09	7.49
Ether Extract (EE)	6.00	5.50	4.80	4.80	5.20
Ash	5.27	5.44	5.15	5.44	2.82
NFE	57.41	57.39	58.14	56.24	68.49
Ca	0.72	0.79	0.92	0.98	0.18
P	0.39	0.42	0.44	0.48	0.22
K	0.80	0.95	0.90	0.85	0.64
Mg	0.88	0.82	0.86	0.79	0.23
Na	0.24	0.29	0.20	0.26	0.14
Metabolisable Energy (Kcal/kg)	3781.74	3741.83	3728.03	3661.24	4021.22

NFE = Nitrogen Free Extract.

Metabolisable Energy (ME) was calculated using the modified formula of Carpenter and Clegg (1956):
ME = 53 + 38 (% CP + 2.2 x % EE + 1.1 x % NFE + 0.22 X % CF).

Table 3: Performance of rabbits fed various dietary levels of millet waste (MW)

	Diet/Treatment				
	1 Control	2	3	4	SEM
Levels of MW (%)	0	10	20	30	-
Number of Rabbits	6	6	6	6	-
Ave. initial liveweight (g/rabbit)	973	998	1000	996	± 221.34(NS)
Ave. final liveweight (g/rabbit)	1569	1547	1524	1506	± 179.89 (NS)
Total liveweight gain (g/rabbit)	596	549	524	510	± 84.06 (NS)
Ave. daily weight gain (g/rabbit/day)	10.64	9.80	9.36	9.10	± 2.78 (NS)
Ave. daily feed intake (g/rabbit/day)	62.16	63.46	63.55	63.71	± 9.22 (NS)
Feed conversion ratio	5.84	6.48	6.79	7.00	± 1.26 (NS)
Mortality (Number)	0	1	1	0	-

a Means in the same row bearing the same superscripts do not differ significantly (P > 0.05)
SEM Standard error of means. NS Not significant (P > 0.05)

Table 4: Apparent utilization of minerals by Rabbits receiving graded levels of millet waste (MW).

Minerals	Diets/Treatments 1(Control)	2	3	4	SEM
Calcium (%)	61.06[b]	55.6[b]	73.96[a]	73.79[a]	± 4.76
Phosphorus (%)	45.45[a]	52.54[a]	50.91[a]	35.00[b]	± 4.07
Potassium (%)	40.27[a]	42.11[a]	41.51[a]	24.44[b]	± 2.54
Magnesium (%)	58.37[a]	57.28[a]	57.29[a]	50.00[b]	± 2.53
Sodium (%)	53.24[a]	50.94[a]	56.28[a]	28.81[b]	± 4.67

SEM Standard error of means

a, b ..... Means with different superscripts in the same row are significantly different (P<0.05).

Table 5. Economic performance of rabbits fed various dietary levels of millet waste (MW).

Parameters	1(control)	2	3	4
Total Feed Intake(g)	3480.96	3553.76	3558.80	3567.76
Feed cost per Kg (₦) *	4.68	4.12	3.52	2.95
Total Feed cost (₦)	16.29	14.62	11.83	10.53
Total weight Gain (g)	596.00	549.00	534.00	510.00
Total Feed Cost/ Kg gain	27.33	26.63	22.58	20.65

* Based on the following prices prevailing at the time (i.e. 1996) of experiment: Maize, ₦6.50/kg; Wheat offal, ₦1.80/kg; Millet waste, ₦0.90/Kg, Fish meal, ₦6.25/Kg; Cotton seed meal, ₦6.00/Kg; Bone meal, ₦0.80 Kg, Groundnut haulm, ₦2.00/Kg; Salt, ₦45.00/Kg and premix, ₦1, 200.00/Kg