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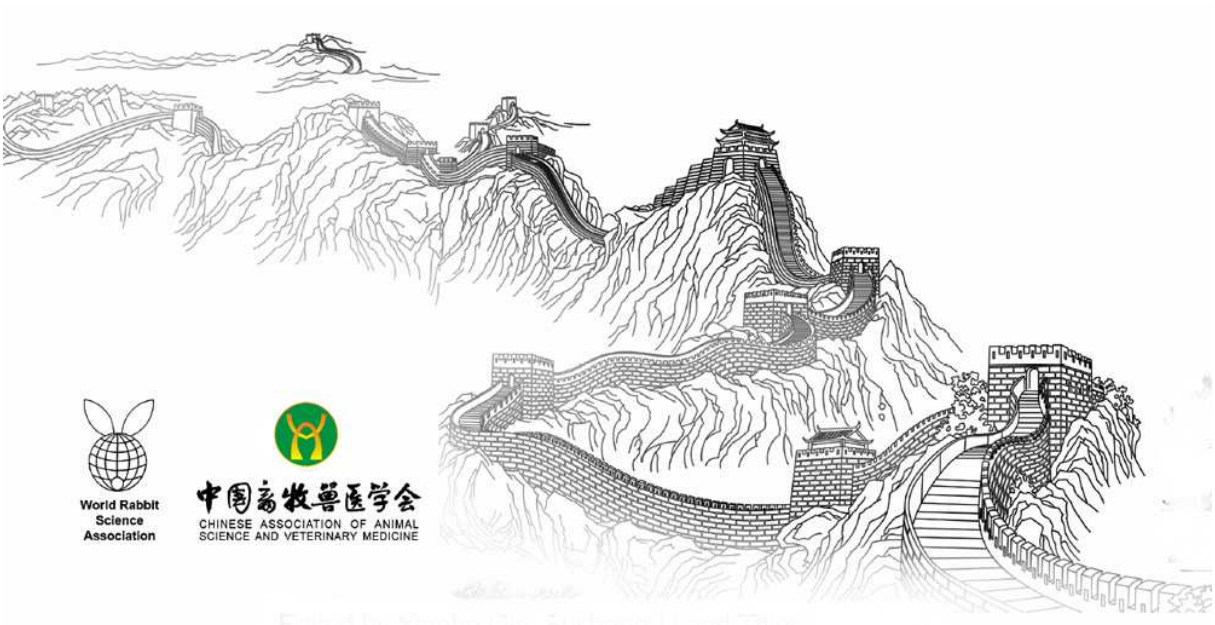

PERFORMANCE AND DIGESTION OF RABBITS FED BREAD WASTE AND *MORINGA OLEIFERA* LEAF AS ENERGY AND PROTEIN SOURCES

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ABSRACT

In an eight-week trial sixty mixed breeds of weaner rabbits aged 5-6 weeks were equally allotted to four treatments to evaluate their performance and digestion when fed bread waste and *Moringa oleifera* leaf as energy and protein sources. Four mash diets (T1, T2, T3 and T4) were formulated by inclusion of bread waste and *Moringa oleifera* leaf at 0, 25, 50 and 100% levels. The crude protein (17.5, 19.0 and 19.2%) and metabolisable energy 2512, 2574 and 2542 kcal/kg) contents of diets containing bread waste and moringa leaf (T2, T3 and T4 respectively) were higher ($p<0.05$) than T1. There was no difference ($p>0.05$) among treatments for the feed intake. The growth of the rabbits fed diet T3 (10.2 g/day) and T4 (10.1g/day) was higher ($p<0.05$) than T2 (9.3 g/day) and T1 (7.7 g/day). The feed conversion ratio was highest ($p<0.05$) in rabbits fed diet T1 (6.10) followed by T2 (5.00), T3 (4.20) and T4 (4.80) which were not different ($p>0.05$). The energy digestibility of diets T4, T3 and T2 (79.3, 75.4 and 74.0% respectively) were higher ($p<0.05$) than T1 (66.0%). The crude protein digestibility of diets T4 (63.6%) and T3 (61.5%) were similar ($p>0.05$) but higher ($P<0.05$) than T2 (57.8%) and T1 (53.4%). It could be concluded that the inclusion of bread waste and *Moringa oleifera* leaf as energy and protein sources led to high protein and energy digestion in rabbits and show improved performances.

Key words: Bread waste, *Moringa oleifera*, Rabbits, Energy, Protein

INTRODUCTION

Feed cost accounts for over 50% of production cost for intensively reared rabbit in the tropics (Ogunsipe *et al*., 2011). The increasing price of the conventional feedstuffs in rabbit's diet has necessitated the search for agro-industrial by-products and forages which are cheap and available all year round. Rabbits have the ability to convert feedstuffs such as forages and agro-industrial wastes and by-products directly into highly nutritious meat. Bread waste, a by-product of bakery industry is rich in energy, low in fibre but high in vitamin (Al-Tulaihan *et al*., 2004). It is an unconventional energy feedstuff available in sufficient quantity, but its utilization as supplemental feed source for rabbits has not been reported. *Moringa oleifera* commonly called horse radish tree is an inexpensive protein source for livestock feeding (Sarwatt *et al*., 2004; Odeyinka *et al*., 2008). Hence, this present study is to evaluate the performance and digestion of rabbits fed bread waste and *Moringa oleifera* leaf as energy and protein sources.

MATERIALS AND METHODS

Animals and experimental design

Sixty weaner rabbits of mixed breeds aged 5-6 weeks were used for the study which lasted for 8 weeks. The rabbits were randomly allocated to four treatments (15 rabbits per treatment) in a completely randomized design, where feed and water were served daily and *ad libitum*. Bread waste was collected, oven dried, packaged and stored for subsequent use. Fresh *Moringa oleifera* leaves were obtained from Sheep and Goat Unit, Obafemi Awolowo University Teaching and Research farm, Ile-Ife, Nigeria and air dried. Four mash diets (T1, T2, T3 and T4) were compounded with inclusion of bread waste and

Moringa oleifera leaf in substitution of corn bran and dried brewer grain at a level of 0, 25, 50 and 100% levels. The animals were subjected to a 7-day adaptation period before the commencement of the experiment. Then animals were subjected to a 7-day digestion trial where sample of faeces collected were bulked, thoroughly mixed, ground and sub-sampled for chemical analysis. Urine samples collected were stored at 4^{o}C for chemical analysis. Calculations were: feed intake, daily weight gain, feed conversion ratio and nutrient digestibility coefficients of rabbits.

Chemical analysis

The proximate analysis of experimental diets and faecal samples was done while the nitrogen content of the urine samples was also determined (AOAC, 2000) while the metabolizable energy was calculated using the equation of Pauzenga (1985):

ME (kcal/kg) = 37 x %CP + 81 x %EE + 35.5 x %NFE.

Table 1: Ingredients experimental diets

Ingredient (%)	T1	T2	T3	T4
Corn bran	40.00	30.00	20.00	-
Brewer's dried grain	40.00	30.00	20.00	-
Bread waste	-	10.00	20.00	40.00
Moringa oleifera	-	10.00	20.00	40.00
Groundnut cake	17.00	17.00	17.00	17.00
Bone meal	2.00	2.00	2.00	2.00
Methionine	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25
Vitamin premix	0.50	0.50	0.50	0.50

[1]Premix provided per kg diet: vitamin A, 12,000 IU; vitamin D3, 1,000 IU; vitamin E acetate, 50 mg; vitamin K3, 2 mg; biotin, 0.1 mg; Fe, 100 mg; Cu, 20 mg; Mn, 50 mg; Co, 2 mg; I, 1 mg; Zn, 100 mg; Se, 0.1 mg; Robenidine, 66 mg.

Statistical Analysis

Data obtained was subjected to a one way analysis of variance procedure of General Linear Model and the Duncan's New Multiple Range option of SAS (2008) was used to separate the means.

RESULTS AND DISCUSSION

The dry matter content of the diets (table 2) containing bread waste and bread waste and *Moring oleifera*; T2, T3 and T4 were lower than that of T1 while the crude protein and metabolizable energy contents of T2, T3 and T4 were significantly higher than T1.

Table 2: The proximate composition of bread waste and experimental diets

Parameters (%)	Bread waste	T1	T2	T3	T4
Dry matter	85.0	96.0	92.0	86.0	88.0
Crude protein	11.0	15.2	17.5	19.0	19.2
Crude fibre	0.1	17.0	16.0	12.0	11.0
Ether extract	19.4	5.5	6.5	6.9	6.8
Ash	1.6	10.0	9.2	8.5	7.5
NFE	54.0	38.5	37.7	37.2	36.2
M.E (kcal/kg)	3870.0	2215.0	2512.0	2574.0	2542.0

NFE: nitrogen free extract. M.E: Metabolizable energy.

The crude protein of bread waste fell below the recommended value for rabbits, while the metabolisable energy met the requirement for maintenance and production (Aduku and Olukosi, 1990). The crude

protein content of the diets was higher than 12.1-16.0% reported by Mmereole *et al.* (2011). The metabolizable energy of all the experimental diets in study was within the range (2400-2800kcal/kg) reported by Pond *et al*. (1995) for growing rabbits. Bread waste and *Moring oleifera* are unconventional energy and protein sources for weaner rabbits especially in the dry season.

The performance characteristic of rabbits fed the experimental diets is shown in table 3. There was no significant difference ($p>0.05$) among the means of the daily feed intake, initial weight and final weight gain of rabbits. Rabbits fed diets T3 and T4 had higher ($p<0.05$) weight gain compared to T2 and T1 whereas the feed conversion ratio was higher ($p<0.05$) in rabbits fed diet T1 compared to T2, T3 and T4 diets. The feed intake obtained in our study was lower than moringa inclusion diet of 60.10-63.40g/day reported for rabbits (Federick, 2010) but similar to 44.73-57.90g/day (Mufwa *et al*. 2011). The weight gain recorded was higher than 6.78-8.64g/day (Odeyinka *et al.* 2008). The feed conversion ratio values obtained were higher than 2.63-3.00 reported by Okorie (2003) but was comparable to 4.22-5.13 (Federick, 2010). Hence, the inclusion of bread waste and moringa leaf in diets of rabbits led to improved performances.

Table 3: Performance characteristics of rabbits fed bread waste and *Moringa oleifera* leaf

Parameters	T1	T2	T3	T4	PROB.	MSE
Feed intake (g/day)	43.1	45.3	42.6	48.4	0.50	1.20
Initial weight (g)	536	543	411	561	0.20	27.7
Final weight (g)	1000	1100	1028	1165	0.20	30.7
Live weight gain (g)	646^{a}	557^{c}	614^{b}	604^{b}	0.048	20.5
Weight gain (g/day)	7.7^{b}	9.3^{ab}	10.2^{a}	10.1^{a}	0.021	0.40
Feed conversion ratio	6.05^{a}	4.90^{ab}	4.15^{b}	4.83^{ab}	0.057	0.30

Means with different letters on the same row differ significantly (Duncan's multiple range). MSE: mean square error

The rabbits fed control diet had a highest ($p<0.05$) dry matter digestibility coefficient than T2, T3 and T4 diets (Table 4).

Table 4: The apparent digestibility coefficient of rabbits fed the experimental diets.

Parameters (%)	T1	T2	T3	T4	PROB.	MSE
Dry matter	82.1^{a}	76.4^{ab}	77.4^{b}	71.1^{b}	0.04	1.84
Energy	66.0^{c}	74.0^{b}	75.4^{b}	79.3^{a}	0.03	1.70
Crude protein	53.4^{c}	57.8^{b}	61.5^{a}	63.6^{a}	0.05	1.30
Crude fibre	69.4^{b}	58.5^{c}	54.9^{c}	71.8^{a}	0.01	1.60
Ether extract	61.9	60.3	60.2	58.5	0.21	1.50
Ash	58.3^{a}	57.2^{a}	46.4^{c}	46.0^{c}	0.04	1.12
NFE	41.0	39.5	37.8	38.1	0.50	0.92

Means with different letters on the same row differ significantly (Duncan's multiple range). MSE: mean square error. NFE: nitrogen free extract.

The energy digestibility of diets T4, T3 and T2 were higher ($p<0.05$) than that of T1. The crude protein digestibility diets T4 and T3 were similar ($p>0.05$) but higher ($P<0.05$) than T2 and T1. The digestibility of dry matter was higher than 65.0-78.4% (Federick, 2010). The crude protein digestibility was lower than 65.1-87.8% reported by Federick (2010) but higher than 26.3 - 62.5% (Iyeghe-Erakpotobor *et al.*, 2006). The diets containing bread waste and Moringa leaf meal had higher energy and crude protein digestibility compared to the control diet which agreed with Fahey *et al.* (2001), thus bread waste and moringa are outstanding indigenous sources of highly digestible nutrients.

CONCLUSION

It could be concluded that the inclusion of bread waste and *Moringa oleifera* leaf as energy and protein sources led to high protein and energy digestion in rabbits and show improved performances.

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