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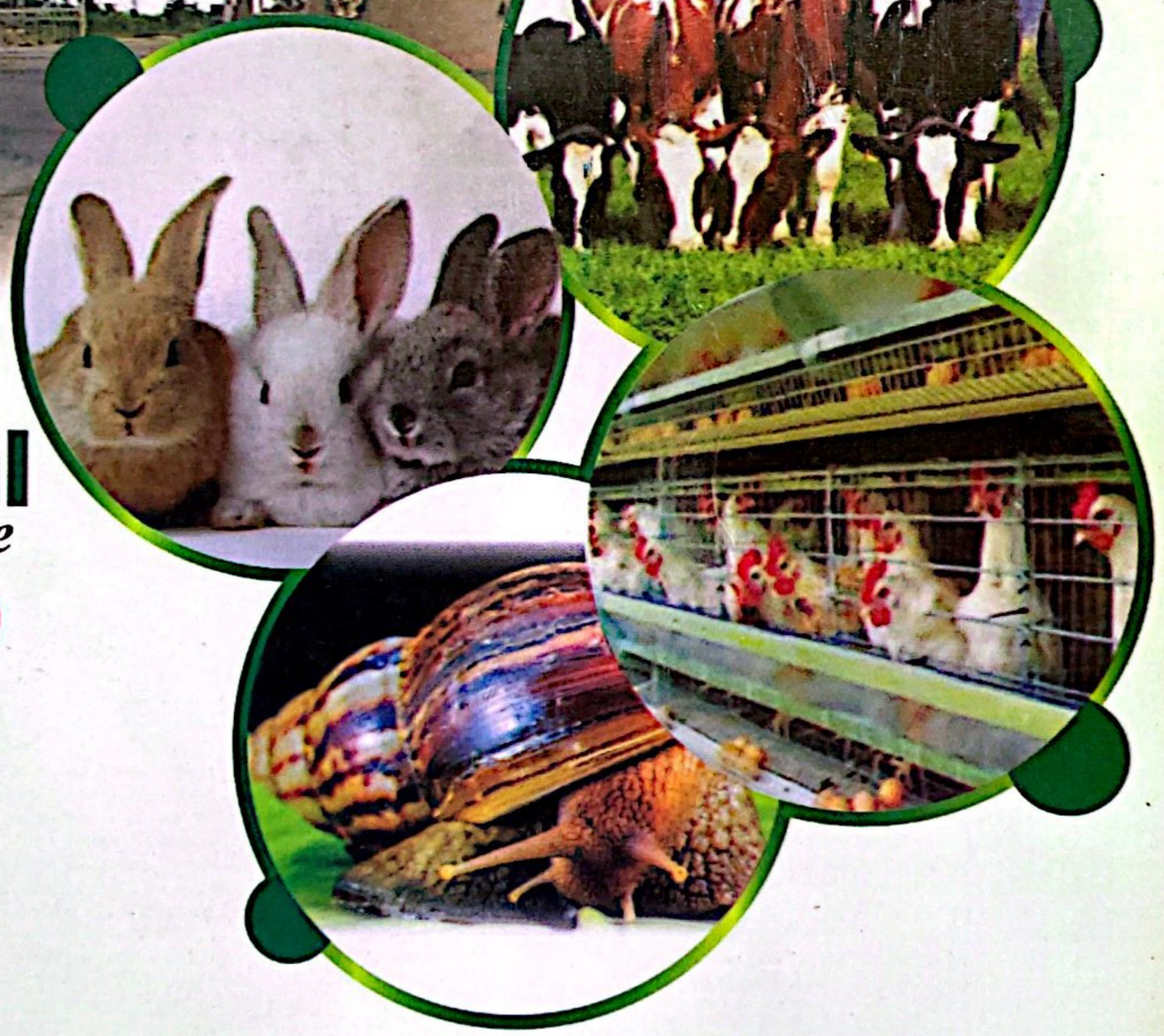

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GROWTH PERFORMANCE AND NUTRIENT DIGESTIBILITY OF WEANER RABBITS *(Oryctolagus cuniculus)* FED DIETS CONTAINING VARYING LEVELS OF COWPEA *(Vigna unguiculata)* MILLINGWASTE

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Abstract
Forty five (45) mixed sex weaner rabbits, aged 5 – 6 weeks, with average initial weights of between 694.42 and 761.10 g were used to investigate the effect of varying levels of cowpea milling waste (CMW) diets on their growth performance and nutrient digestibility. They were randomly distributed to five dietary treatments with nine rabbits per treatment. The control treatment (T_1) contained 0 % CMW while treatments T_2, T_3, T_4 and T_5 had 10, 20, 30 and 40 % CMW respectively. Clean water and feed were offered to the animals *ad libitum* daily and record of their feed intake and growth performance were taken for 12 weeks. At the 12th week, a nutrient digestibility trial was carried out. Results show that there were no significant ($p>0.05$) differences in final body weight, body weight gain, total feed intake and mortality among the dietary treatments. Feed conversion ratio (FCR) for diets T_4 and T_5 (containing 30 and 40 % CMW respectively) were as good as that of the Control Diet. Dry matter and crude protein digestibility showed no significant ($p>0.05$) difference across the treatments. Digestibility of crude fibre (CF), ether extract (EE), ash and nitrogen free extract (NFE), as well as total digestible nutrient (TDN) of the test diets compared favourably with that of the Control Diet. Hence, it can be concluded that CMW can be used safely as a protein source and included up to 40 % in weaner rabbit diets with no detrimental effect on their growth performance and nutrient digestibility.

Keywords: *cowpea milling waste, growth performance, weaner rabbits*.

Introduction

In most developing countries of the world today, there is high incidence of inadequate consumption of animal protein. It is estimated that on the average, animal protein consumed per person per day (4.5 g) falls short of the recommended 35 g requirement (FAO, 2009).The increasing demand for animal protein necessitates the need to intensify livestock production. *Increased rabbit production is a fast means of meeting the animal protein requirements of the Nigerian populace (Iyeghe-Erakpotobor et al., 2002).* Rabbit (*Oryctolagus cuniculus*) has short generation interval, high prolificacy, good mothering ability and easy management requirements, with ability to utilize waste and other non-conventional feed sources. Besides, rabbit meat is high in protein (about 22 %), low in fat (about 4 %) and cholesterol (about 5 %) which can contribute positively towards improving the good health of the populace (Aduku and Olukosi, 1990).

Cowpea, a legume crop, contains adequate amounts of protein, essential amino acids, dietary fibre and essential minerals and vitamins when compared to the other common legumes (Bhat and Karim, 2009). Studies have shown that 20 % dietary inclusion of cowpea seed produced better performance with no reported negative effect on weaner rabbits *(*Matondi *et al.,* 2015). However, there is paucity of information on the use of cowpea milling waste as a non-conventional feedstuff for feeding weaner rabbits; hence this research study is aimed at determining the growth performance and nutrient digestibility of weaner rabbits fed diets containing varying levels of cowpea milling waste.

Materials and Methods

This research study was carried out at the Rabbitry Unit of the Ministry of Livestock and Fisheries Development, Minna, Niger State. Minna lies within the Guinea Savannah zone of Nigeria. It is located within latitude 9°37' North and longitude 6°33' East (Niger State Agricultural Development Project, 2009). A total of 45 mixed sex weaner rabbits aged between 5-6 weeks, with average weights of between 694.42 and 761.10 g were randomly divided into five treatments and further sub-divided into three replicates with three rabbits per replicate in a Completely Randomized Design (CRD) Experiment. Specially constructed wooden cages of height 60 cm, length 45 cm and width 40 cm, with floor space of 0.39 to 0.55 cm^2 and net fitted floor were used for the experiment. Prior to the commencements of the experiment, the cages were thoroughly washed with disinfectant (Izal® solution). Feeders and drinkers were provided in each cage for easy access by the animals. The rabbits were de-wormed using Albendazole®; broad spectrum antibiotic and Vitalyte® were administered via the drinking water to reduce stress. The rabbits were allowed to acclimatize to the new environment for one week while being fed with the Control Diet (T_1). Thereafter, the experimental diets T_2, T_3, T_4 and T_5 (containing 10, 20, 30 and 40 % CMW respectively) and water were served *ad-libitum* to the rabbits in each replicate respectively for 12 weeks. The composition of the experimental diets is shown in Table 1.

Table 1: Composition of the experimental diets for weaner rabbits

Ingredients (%)	Diet 1 (0%)	Diet 2 (10%)	Diet 3 (20%)	Diet 4 (30%)	Diet 5 (40%)
Maize	43.38	37.21	31.62	26.03	20.50
Groundnut cake	29.62	25.79	21.38	16.97	12.50
Cowpea milling waste	00.00	10.00	20.00	30.00	40.00
Rice husk	20.00	20.00	20.00	20.00	20.00
Palm oil	2.00	2.00	2.00	2.00	2.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Limestone	0.50	0.50	0.50	0.50	0.50
Lysine	0.50	0.50	0.50	0.50	0.50
Methionine	0.45	0.45	0.45	0.45	0.45
Salt	0.30	0.30	0.30	0.30	0.30
*Premix	0.25	0.25	0.25	0.25	0.25
	100	**100**	**100**	**100**	**100**
Calculated Analysis					
Crude Protein	18.21	18.43	18.42	18.24	18.40
ME (Kcal/kg)	2712	2699	2690	2682	2674
Crude fibre	10.75	11.85	12.93	14.02	15.09
Protein: calorie	1:149	1:146	1:146	1:147	1:145
Calcium	1.39	1.37	1.36	1.35	1.33
Phosphorous	0.85	0.83	0.82	0.80	0.80
Lysine	1.27	1.38	1.53	1.79	1.79
Methionine	0.73	0.85	0.94	1.05	1.15

*2.5 kg of the premix supplied the following nutrients: Vitamin A, 500 IU; Vitamin D_2, 1500 IU; Vitamin E, 3 IU; Vitamin K, 2 mg; Riboflavin, 3 mg; Pantothenic acid, 6 mg; Niacin, 15 mg; Vitamin, B_{12} 0.8 mg; Chlorine, 3 mg; Folic acid, 4 mg; Manganese, 8 mg; Zinc, 0.5 mg; Iodine, 1.0 mg and Cobalt, 1.2 mg.

ME = Metabolizable energy

At the end of the 11th week of the feeding trial, a nutrient digestibility trial was carried out using two animals per replicate, housed in specially constructed metabolism cages. Known quantities of feed were fed to the animals in each replicate in the morning and left over collected the following morning for five days, after three days adjustment period in the cages. Using the total collection method, faecal droppings were collected daily in aluminium foils, weighed, preserved with boric acid and oven dried at 80 ^{0}C for 24

hours. At the end of the experiment, the dry matter, crude protein, crude fibre, ether extract, nitrogen free extract and ash content of the experimental diets, collected faecal samples and CMW were determined using the procedures of AOAC (2000). All data collected were subjected to analysis of variance (ANOVA) using Statistical Analysis System (SAS). Where treatment means were significant (P<0.05), Duncan's Multiple Range Test was used to separate the means (Duncan, 1955).

Results and Discussion

The proximate composition and energy value of cowpea milling waste (Table 2) shows that it is a potential source of protein and energy in livestock diets.

Table 2: Proximate composition and calculated energy value of cowpea milling waste (CMW)

Parameters	% Composition
Dry matter	97.00
Ash	9.00
Crude protein	24.85
Crude fibre	14.00
Ether extract	5.00
Nitrogen free extract	44.15
Metabolizable energy (Kcal/kg)	2892

Table 3 shows the growth performance of weaner rabbits fed diets containing varying levels of cowpea milling waste (CMW) while Table 4 shows the apparent nutrient digestibility of weaner rabbits fed diets containing varying levels of CMW. The results disagree with that of Iyeghe-Erakpotobor *et al.* (2006) who fed crossbred weaner rabbits with five treatment diets consisting of 100, 75, 50 and 25 % levels of soybean cheese waste/maize offal diet (SBW). Intake of concentrate was significantly higher for weaner rabbits fed the control diet than the 100 % diet of soya beans cheese waste. Similar concentrate intake was observed for 75 and 50 % diets of soya beans cheese waste.

Table 3: Growth performance of weaner rabbits fed diets containing varying levels of cowpea milling waste

Parameters (%)	$T_{1(0\%)}$	$T_{2(10\%)}$	$T_{3(20\%)}$	$T_{4(30\%)}$	$T_{5(40\%)}$	SEM	P-Value
Initial body weight (g)	733.33	694.42	761.10	711.13	744.47	14.68	0.6905
Final body weight (g)	1788.90	1711.20	1727.80	1816.70	1852.80	34.15	0.7203
Body weight gain (g)	1038.90	1016.70	966.70	1105.50	1108.30	40.00	0.8213
Total feed intake (g)	6238.40	7555.60	7487.20	7316.40	7294.40	259.38	0.5889
FCR	6.11^{a}	7.46^{b}	7.70^{b}	6.63^{ab}	6.66^{ab}	0.21	0.0836
Mortality	0.00	0.67	0.33	0.33	0.33	0.15	0.8335

^{ab}Means with different superscripts on the same row were significantly (P<0.05) different.

SEM = Standard error of mean. FCR = Feed Conversion ratio.

Dry matter and crude protein digestibility showed no significant (p>0.05) difference across the treatments. Digestibility of crude fibre (CF), ether extract (EE), ash and nitrogen free extract (NFE), as well as total digestible nutrient (TDN) of the test diets compared favourably with that of the Control Diet.

This result disagree with the report of Orji (2009) who fed cowpea hulls (CPH) at 0, 10, 20 and 30 % dietary inclusion levels to hybrid rabbits. They observed that there were significant ($p<0.05$) differences among the treatments on dry matter and crude protein digestibility. Also, significant ($p<0.05$) differences were observed in digestibility of crude fibre, ether extract and nitrogen free extracts. Generally, digestibility decreased gradually with increase in the addition of CPH in the diets. However, in this research study, crude fibre digestibility improved with higher inclusion levels of CMW.

Table 4: Apparent nutrient digestibility of weaner rabbits fed diets containing varying levels of cowpea milling waste

Parameters	$T_{1(0\%)}$	$T_{2(10\%)}$	$T_{3(20\%)}$	$T_{4(30\%)}$	$T_{5(40\%)}$	SEM	P-value
Dry matter	86.98	86.40	87.56	87.97	86.81	0.30	0.5468
Crude protein	81.42	81.41	82.29	81.26	81.85	4.92	0.4952
Crude fibre	72.94^{b}	72.64^{b}	80.16^{a}	84.04^{a}	80.90^{a}	1.29	0.0001
Ether extract	95.23^{ab}	95.98^{a}	94.90^{b}	96.04^{a}	94.38^{b}	0.20	0.0152
Ash	43.74^{c}	54.62^{b}	63.54^{a}	50.15^{bc}	44.07^{c}	2.17	0.0010
NFE	96.04^{a}	94.30^{bc}	95.18^{ab}	93.58^{c}	94.90^{ab}	0.26	0.0001
TDN	80.47^{c}	83.69^{a}	76.11^{d}	81.67^{b}	80.02^{c}	0.67	0.0001

^{abcd}Means with different superscripts on the same row were significantly ($P<0.05$) different.

SEM = Standard error of means NFE = Nitrogen free extract TDN = Total digestible nutrients

Conclusion and Recommendations

From the results of this research study, it can be concluded that cowpea milling waste can be used safely as a protein source and included up to 40 % in weaner rabbit diets with no detrimental effect on their growth performance and nutrient digestibility.

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