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INFLUENCE OF PRE-TREATMENT METHODS AND LEVELS OF INCLUSION OF CASSAVA PEEL /BLOOD MEAL MIXTURES ON NUTRIENT UTILIZATION AND RELATIVE ORGAN WEIGHTS OF RABBIT DOES

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ABSTRACT: A 12 weeks feeding trial was conducted to investigate the effects of pre-treatment methods and levels of inclusion of cassava peel/blood meal mixtures (3:2) on nutrient digestibility and relative organ weights of rabbits does.Ten diets were formulated with diet 1 serving as the control without cassava peel/blood meal mixture. Diets 2, 5 and 8 had 10% cassava peel+blood meal mixture, Diets 3, 6 and 9 had 20% cassava peel+blood meal mixture while Diets 4,7 and 10 had 30% cassava peel+blood meal mixture. For diets 2, 3 and 4 cassava peels were ash-treated (ATD/BM), for diets 5, 6 and 7 the cassava peels were parboiled (PAB/BM) and for diets 8,9 and10 the cassava peels were sun dried (SUD/BM). The rabbits were divided into 10 treatment groups of six rabbits each and assigned randomly to the ten diets. Each rabbit served as a replicate in a randomized complete block design experiment in a factorial arrangement. The digestibility of nutrients was affected (P<0.05) by pre-treatments methods as well as levels of inclusion levels. Although the digestibility of the various nutrients differs (P<0.05) and did not follow a specific pattern, both the pre-treatment methods as well the levels of inclusion did not affect (P>0.05) the final Live weight of the rabbits. Pre-treatment methods as well as the level of inclusion affected (P<0.05) the relative organ weights of the spleen and kidney. From the results these non-conventional feed ingredients can be included in growing rabbit diet up to 30% level since performance especially final live weights were not affected.

Keywords: Pre-treatment, Cassava Peels, Rabbit, Digestibility, Organ Weights

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INTRODUCTION

Livestock plays an integral role in the livelihood of poor farmers by providing economic, social food security (FAO, 2011) It is one of the fastest growing agricultural subsectors in the developing countries, but there is considerable shortage of feed availability in most of these developing countries (Wadhwa and Bakshi, 2013). In an attempt to solve the challenging animal protein inadequacy in Nigeria, series of livestock development drive have been embarked on by the government. Two major identified areas of focus are the production of animals that are fast growing and reduction of the production cost to make the meat and other animal products available and affordable. The potentials of rabbit in combating the animal protein inadequacy had earlier been highlighted by Ojebiyi et al., 2006. Daudu et al. (2009) reported that non-conventional feedstuff (NCF) offer the best alternative for the reduction of feed cost which will ultimately lead to reduction in the price of meat and other animal products. However for these NCFs to play these roles they must be available all year round and easy to procure and processed if need be. Cassava peel is among other by-products that are readily available in Nigeria and have no direct dietary value in human diets. This is because during cassava processing into human food, the peels which accounts for between 10-13 % of the tuber weight is often left to rot away at various processing sites. The peel is characterized by high fibre, low protein and high hydrogen cyanide content (an anti-nutritional factor) and requires some form of processing to appreciably reduce the cyanide content to acceptable or tolerant level thus improving the utilization. Tewe (1991), suggested that the processing techniques to be used for reduction of cyanide must consider the labour costs and the effect of the processing on the nutrient profile. Blood meal is one of the waste products from abattoir in Nigeria. Although it is rich in crude protein and most amino acids particularly lysine, it is low in isoleucine and poor in calcium and phosphorus (Rahjhan, 2001) and when processed could be appreciably incorporated to animal feed. According to Daudu et al. (2009), the best way in assessing the suitability of a feed ingredient for rabbit nutrition is to include graded levels in the diet and ensuring that all nutrients required by the animal are supplied while performance is measured to know the optimum inclusion level.

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The present study is aimed at evaluating the effect of different pre-treatment methods and levels of inclusion of peel/blood meal mixtures on nutrient digestibility and relative organ weights of rabbit does.

MATERIAL AND METHODS

The experiment was carried out at the Rabbitary Unit of the Teaching and Research Farm, Ladoke Akintola University of Technology, Ogbomoso Oyo State Nigeria. Ogbomoso is in the derived savannah zone of Nigeria.

Test ingredients:

The cassava peels used in this study were processed in three ways: these are ash treatment, parboiling and sun drying. The collection and processing is as described by Ojebiyi et al. (2008).

Formulation of Experimental diets:

Cassava peel-blood meal mixtures was prepared by combining each of the ash treated, parboiled and sundried cassava peels and blood meal in ratio 3:2. Ten diets were formulated, diet one which served as the control contained no cassava peel+blood meal mixture; diets 2, 3 and 4 contained either 10, 20 or 30% ash treated cassava peel+blood meal; diets 5, 6, and 7 contained either 10, 20 or 30% parboiled cassava peel+blood meal mixture while diets 8, 9 and 10 contained either 10, 20 or 30% sun dried cassava peel+blood meal mixture. The composition of the diet is shown in Table 1.

Table 1 - Percentage composition of experimental diets

Ingredients	Control	Percentage Composition								
		AA			PP			SS		
		10	20	30	10	20	30	10	20	30
Maize	12.25	12.25	12.25	12.25	12.25	12.25	12.25	12.25	12.25	12.25
Corn meal	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00
GNC	14.50	8.00	3.00	0.00	8.00	3.00	0.00	8.00	3.00	0.00
PKC	27.0	23.50	18.50	11.50	23.50	18.50	11.50	23.50	18.50	11.50
Fish meal	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Cassava peel / Blood Meal	0.00	10.00	20.00	30.00	10.00	20.00	30.00	10.00	20.00	30.00
Molasses	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Salt	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Bone meal	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Premix[1]	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Total	100	100	100	100	100	100	100	100	100	100
Energy (kcal/kg)	2454.02	2342.25	2437.46	2441.97	2342.25	2437.46	2441.17	2442.25	2437.25	2441.97

[1]Premix composition; content per 1kg diet: Vitamin A 3,200,000iu; Vitamin D_3 1,200iu; Vitamin E 3,200iu; Vitamin k_3 800mg; Vitamin B_1 400mg; Vitamin B_2 2000mg; Vitamin B_{12} 2000mg; Niacin 400mg; Selenite (Se) 40mg; manganese (Mn) 3200mg; Pantothenic acid 2000mg; Folic acid 200mg; Chlorine (Cl) 60,000mg; Iron (Fe) 8,000mg; Copper (Cu) 3,200mg; Zinc (zn) 2,000mg; Cobalt (Co) 90mg; Iodine (I).

Experimental Animals and Management:

A total of 60-cross bred (New Zealand white × Chinchilla) female weaned rabbits of 5-7 weeks of age with mean weight of between 609.90 - 612.710 g were used for the study. They were divided into 10 treatment groups of 6 rabbits with each rabbit serving as a replicate in a completely randomized block design experiment in a factorial arrangement. The rabbits were housed individually in wood-wire cages with dimensions of 44×34×44cm. The drinking and feeding troughs were earthen pot re-enforced with cement to prevent tipping off. A total of 100g feed divided into two rations of 50g in the morning (8:00hr) and 50g in the evening (16:00hr) were supplied to each rabbit per day. The cages were designed in such a way that allows easy collection of faeces, urine and left over feeds to avoid buildup of odour and pathogens. At the commencement of the experiment the rabbits were weight-balanced such that the difference in weight between treatments was less than ± 3.00g.

Data collection

Feed Intake: Weighed quantity of feed was given to each animal and the left over was collected daily and weighed to evaluate the feed intake of each animal.

Digestibility trial: During the 12th week, daily faecal output was collected from each animal for 5 days, sun-dried, weighed and stored in plastic bags. The sample was bulked together ground and sub sample taken for proximate analysis.

Carcass and organ weights: At the end of the experiment the rabbits were tagged and starved for 12 hours before being slaughtered. After bleeding the rabbits were eviscerated to remove the internal organs for measurement. The dressed carcasses as well as the organ weights were expressed as a percentage of body weight.

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Laboratory Analysis

The experimental diets, tests ingredients as well as the faecal samples were analyzed for proximate composition by the methods of AOAC (2005).

Statistical Analysis

The data collected were subjected to Analysis of variance using General Linear Model procedure (GLM) of SAS (2000) and means were compared using Duncan multiple Range Test option of the same statistical package.

RESULTS AND DISCUSSION

The proximate composition of the experimental diets revealed that the protein content ranged between 16.74-18.16% while the calculated metabolizable energy ranged between 2342.25-2454.02 kcal/kg (Table 2). The crude protein values are similar to that of Okeke et al. (2009) but lower than that of Alu et al. (2009). However the values fall within the range recommended by Lebas (1979) and NRC (1984) for growing rabbits. Nutrient digestibility as influenced by the pre-treatments methods is presented in Table 3. This shows that the pre-treatment methods did not have any significant (P>0.05) effect on dry matter digestibility, crude fat digestibility, and ash digestibility. However crude protein, crude fibre and Nitrogen free extract digestibilities were significantly (P<0.05) affected by dietary treatments.

Table 2 - Proximate composition of the Experimental diets

Nutrient	CC	AA			PP			SS		
		10	20	30	10	20	30	10	20	30
DM (%)	89.09	89.58	89.01	89.04	89.45	89.11	89.24	89.44	89.28	89.39
CP (%)	18.27	16.74	16.92	18.16	17.95	17.87	18.03	17.12	17.68	17.48
CFAT (%)	4.13	3.69	3.73	3.78	3.89	4.04	3.95	3.86	3.93	4.07
ASH (%)	7.32	6.82	6.94	7.13	7.18	7.24	7.08	6.97	6.94	6.86
CF (%)	8.87	7.87	8.14	8.04	8.09	7.98	8.54	8.94	8.69	8.75
NFE (%)	68.73	71.7	71.21	70.02	70.07	70.11	69.48	70.08	69.7	69.7
ENERGY (kcal/kg)	2454.02	2342.25	2437.46	2441.97	2342.25	2437.46	2441.17	2442.25	2437.25	2441.97

CC = Control diet (0% cassava peel/ blood meal), AA = Ash treated cassava peel meal, PP = Parboiled cassava peel meal, SS = Sundried cassava peal meal, DM = Percentage dry matter, CP = Percentage crude protein, CFAT = Percentage crude fat, CF = Percentage crude fibre, NFE = Percentage nitrogen free extract, G.E (kcal/g) = Gross energy kilocalorie per gram.

Table 3 - Main effect of pre-treatment method on performance of rabbit does fed diet containing treated cassava peel/blood meal mixtures

Parameters	Treatments				SEM
	Control	ATD/BM	PAB/BM	SUD/BM	
Initial weight	609.90	610.00	610.70	612.70	139.00
Final weight	1363.39	1277.5	1314.4	1323.3	269.00
Digestibility					
Dry Matter Digestibility (%)	61.17	63.4	54.75	57.47	15.05
Crude Protein Digestibility (%)	57.23^{ab}	61.96^{a}	52.39^{b}	52.16^{b}	16.12
Crude Fibre Digestibility (%)	32.97^{b}	38.91^{a}	41.91^{a}	41.65^{a}	6.05
Crude Fat Digestibiity (%)	84.83	85.42	83.18	83.91	15.88
Crude Ash Digestibility (%)	72.83	70.54	64.41	63.38	12.39
Nitrogen Free Extract Digestibility (%)	83.83 ^{a}	77.88 ^{b}	72.77 ^{b}	75.15 ^{b}	10.49

^{ab} Means along the same row with different superscripts are significantly deferent (P<0.05). ATD/BM =Ash treated cassava peel+blood meal mixtures, PAB/BM=parboiled cassava peel+blood meal mixtures, SUD/BM =sun dried cassava peel+blood meal mixtures, SEM=standard error of mean.

The values obtained in crude protein digestibility of the rabbits that were fed cassava peel blood meal mixtures were comparable with the control irrespective of the processing method employed for cassava peel. A slight higher but insignificant value was observed for ash treated cassava peel when compared with the control. This may be due to the partial digestion of cellulose and enzyme secreted by microbes during the 24 hours soaking in ash thus making it easy for digestion by the rabbits. This observation is similar to the report of Adejinmi et al. (2007). Digestibility of crude fibre was higher (P<0.05) in the rabbits that received treated cassava peel compared with control. However, digestibility of Nitrogen free extract was significantly (P<0.05) lower in the rabbits that were fed treated cassava peel. This may be attributed to the fact that various processing applied enhanced the nutrient utilization.

The main effect of levels of inclusion of cassava peel/blood meal mixtures is presented in Table 4. The final live weights, and digestibility of dry matter, crude protein, crude fibre and ash were not significantly (P>0.05) affected by levels of inclusion of cassava peel+blood meal mixture in the diets. However digestibility coefficients of crude fat and nitrogen free extract were affected (P<0.05). The 30% inclusion levels had significantly (P<0.05) depressing effect on fat digestibilty. Although the values obtained for crude fibre digestibility were not significantly (P<0.05) affected across the treatments the trend shows that it decrease linearly as the level of inclusion increases. This may mean that as the level of inclusion of cassava peel/blood meal increased there is the possibility of

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increase fibre and cyanide which is an anti- nutritional factor. According to Merck (1988), most toxicant including methylxanthine interfere with enzyme system by denaturing enzyme protein and binding to the enzyme molecule thus inhibiting the digestive potential of animals. Cheeke (1987), had earlier reported that fibre is poorly digested in rabbit as this is rapidly propelled through the colon and excreted as hard feaces. This observation is confirmed in this study because across the treatments crude fibre digestibility is comparatively lower than other nutrients. However, the performance in terms of final Live weight were not significantly (P>0.05) affected in spite of the variations in the digestibility coefficients.

The main effects of pre-treatment methods on organ characteristics of rabbit does is presented in Table 5. Final live weight, eviscerated weight, dressing percentage, heart weight, lung weight, spleen weight, kidney weight and liver weight of the rabbits in this experiment were not affected (P>0.05) by the pre-treatment method of cassava peel/blood meal.

Table 4 - Main effect of level of inclusion of treated cassava peel/blood meal mixtures on performance of rabbit does

Parameters	Inclusion levels (%)				SEM
	0	10	20	30	
Initial weight	609.90	612.30	613.60	611.10	139.00
Final weight	1363.39	1334.06	1312.31	1312.50	269.00
Digestibility					
Dry Matter Digestibility (%)	61.17	65.04	64.24	64.16	15.05
Crude Protein Digestibility (%)	67.23	61.99	61.59	61.20	16.12
Crude Fibre Digestibility (%)	32.97	32.92	29.02	28.39	6.05
Crude Fat Digestibility (%)	84.83[a]	86.62[a]	86.09[a]	79.12[b]	15.88
Crude Ash Digestibility (%)	72.83	75.59	71.12	71.57	12.39
Nitrogen Free Extract Digestibility (%)	83.83[a]	63.41[b]	76.81[a]	77.01[a]	10.49

[ab] Means along the same row with different superscripts are significantly deferent (P<0.05); SEM= Standard error of Mean.

Table 5 - effect of pre-treatment method on organ characteristics of rabbit does fed diet containing cassava peel/blood meal mixture

Parameter	CC	Treatment		
		AA	PP	SS
Final live weight (g)	1363.30	1298.88	1326.63	1333.00
Eviscerated weight (g)	678.18	695.95	664.19	649.23
Dressing Percentage (%)	49.7	53.48	50.00	48.65
Heart weight (g)	2.93	3.14	2.98	3.16
Lung weight (g)	6.20	5.97	6.76	6.44
Spleen weight (g)	0.95	0.72	0.84	0.73
Kidney weight (g)	7.40	7.91	8.31	8.36
Liver weight (g)	37.95	33.24	36.98	36.38

CC = Control diet (0% cassava peel/ blood meal), AA = Ash treated cassava peel meal, PP = Parboiled cassava peel meal, SS = Sundried cassava peal meal.

This may be indication of the effectiveness of the methods used in treating cassava peels in this study. The main effects of levels of inclusion are presented in Table 6. The inclusion levels of cassava peel+blood meal mixture did not affect (P>0.05) the final body, eviscerated weights, the dressing percentage, the relative heart, lungs, and liver weights. The relative spleen weights of rabbits in treatments 1(0%), and 2(10%) are similar (P>0.05) but lower (P<0.05) than weights of those rabbits placed on 20% and 30% levels. The weights increased linearly with increased level of cassava peel+blood meal mixture in the diet.

Table 6 - the main effect of level of inclusion of cassava peel/blood meal mixture on organ characteristics of rabbit does.

Parameter	CC (0%)	Level 10%	of Inclusion 20%	30%
Final Life Weight (g)	1363.30	1324.3	1294.3	1295.6
Eviscerated Weight (g)	678.18	693.01	654.88	653.08
Dressing Percentage (%)	49.7	52.40	50.20	50.53
Heart weight (g)	2.93	3.10	2.98	3.35
Lung Weight (g)	6.20	6.33	6.24	6.79
Spleen Weight (g)	0.66[b]	0.68[b]	0.78[a]	0.95[a]
Kidney Weight (g)	7.40[b]	7.67[b]	7.87[b]	9.40[a]
Liver Weight (g)	37.95	33.68	33.63	36.87

[ab]Means along the same row with different superscripts are significantly different (P <0.05). CC=control

The relative spleen weights obtained in this study however falls within the value reported by Dairo et al. (2002) but lower than the value reported by Omole and Sonaiya (1981). This may be due to difference in the content of the feeds and management practices. The spleen is one of the reticulo-endothelial organs which function to destroy worn out red corpuscles releasing the iron from the haemoglobin for re-use by the body and also forming pigments which are then collected by the liver. According to Frandson (1981), many lymphocytes and monocytes are formed in the spleen, and it is probably associated with anti-body production. The results also shows that rabbit on the 30% inclusion had

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the highest value (9.40g) for relative kidney weights when compared with the control (7.40), 10% (7.67g), and 20% (7.87g). These values are lower than the values reported by Ijaiya (2002). This may be due to difference in feed composition (Agunbiade et al., 1999). Kidney enlargement has been attributed to high deposition of uric acid related compounds (Opstevdt, 1988; Idowu and Eruvbetine, 2005). The swelling and enlargement of these vital organs may be due to toxic degenerative factors (Synder, 1990; Mitchell and Cotran, 2003). The incriminating factor in this study could be the residual HCN in the diet.

CONCLUSION

The study seems to suggest that rabbit does can tolerate up to 30% cassava peel+blood meal mixture without any adverse effect on body weight. When viewed in terms of nutrient utilization it can also be concluded the ash treatment of cassava peel is more effective than parboiling and sun drying before preparing the cassava peel+blood meal mixture. The test ingredients are easy to acquire and are of low value in human nutrition, consequently their inclusion in rabbit diets will lead to increase rabbit production, higher inclusion level as well as fortification with growth promoters will be focus of further studies.

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