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Response of weaner rabbits fed graded levels of palm kernel cake (PKC) as replacement of wheat offal

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Target Audience: *Animal nutritionists, rabbit farmers and feed manufacturers*

Abstract

A six weeks experiment was conducted to evaluate the performance of weaner rabbits fed graded level of palm kernel cake (PKC) as replacement of wheat offal. Four dietary treatments were formulated in which PKC replaced wheat offal at 0, 20, 40 and 60 % coded as diet 1, 2, 3 and 4. A total of twenty-four (24) weaner rabbits were randomly allotted into four dietary treatment groups in a completely randomized design. Each treatment contained six (6) rabbits replicated three times with 2 animals per replicate. The highest final weight (1237.50 g) and total weight gain (812.50 g) were obtained from the group on diet 3, while the least values were recorded on those fed diet 1 (950.00 and 575.00 g, respectively). Similarly, weekly and daily weight gains were significantly (P<0.05) higher for the group on diet 3 compared to those fed diets 4, 2 and 1. However, daily feed intake and fed conversion ratio of the experimental diets were similar. Most of the carcass parameters measured were not affected by the dietary levels of PKC except lung weight where the highest values were recorded in treatment 2, which did not vary from the result obtained from treatment 4, but significantly (P<0.05) higher than those on treatment 1 and 3. It was concluded that PKC can replace wheat offal at up to 60 % level of inclusion without compromising growth performance and carcass yield.

Key words: *Weaner rabbits, Palm kernel cake, Growth performance and Carcass yield*

Description of Problem

Rabbits produce healthy meat because of its low cholesterol and salt. Currently, rabbit meat consumption is increasing because of its high protein. It is also highly palatable and can be used as chicken substitute (1). Rabbit meat is encouraged for diabetics, hypertensive patients and aged because of its low uric acid produces during metabolism (2). They produce higher litter size and had short gestation period of 30 days. (3). Earlier research of (4) showed that a single rabbit doe can produces a minimum of 120 kg of high-quality meat per annum. This could be the reason why commercial rabbit farming is gaining popularity in many tropical countries, especially in West Africa (5). Rabbits are good foragers because they possess a well-developed ceacum that harbored micro-organisms. These microbes aid in the fermentation of fibrous material to volatile fatty acids. Feeding of rabbits with forage as a sole diet resulted to poor performance. This is due to seasonal variation in quality and quantity of many forages (6). Therefore, the need to supplement forage with formulated ration emerged. This suggestion was challenged by the fact that the available inputs for supplement formulation were priced high (2)

and it is well documented that over 50 % of total cost of rabbit production accounted for feed (7). This has resulted to new approach of livestock farming (8). Also, the competition between man and livestock for these feed ingredients call for search for alternative non-conventional feed stuffs. Palm kernel cake (PKC); a solid waste left after manual extraction of oil from the kernel of palm fruits is one of such by-products that can be used as protein or energy source in rabbits' diet (9). It is cheaper than wheat offal and readily available in tropical areas of the world (10) specifically Nigeria. Estimated annual production of 785,000 metric tons was reported (11) and is not consumed as food by man. The proximate analysis of PKC indicated crude protein of 18.5 - 21.3 % (12) and crude fibre of 9.07 - 24.9 % (13; 14), while for the metabolizeable energy, (15) and (16) reported values of 6.74MJ/kg and 6.20MJ/kg, respectively. It has been used in poultry, pigs and ruminant rations as feed ingredient (9; 17), but scanty information on its effects on rabbit performance was available. There was high competition on wheat offal as important ingredient in poultry and livestock feed, this usually results in artificial shortages and price escalation (18). Therefore, the present study aims at assessing the performance of weaner rabbits fed graded level of PKC as replacement of wheat offal.

Table 1: Ingredients and percentage composition of the experimental diets

	Diet			
Ingredients	1	2	3	4
Maize	21.2	21.1	21.1	21.1
Groundnut cake	4.1	4.1	4.1	4.1
Wheat offal	60	40	20	0
Palm kernel cake	0	20	40	60
Groundnut hay	10	10	10	10
Fish meal	2.0	2.0	2.0	2.0
Bone meal	2.0	2.0	2.0	2.0
Salt	0.25	0.25	0.25	0.25
*Vit./min. premix	0.24	0.24	0.24	0.24
Methionine	0.1	0.1	0.1	0.1
Lysine	0.1	0.1	0.1	0.1
Total	100	100	100	100
Calculated analysis				
Crude protein	17.0	17.0	17.0	17.0
Crude fibre	9.06	9.26	9.46	9.66
Ether extract	4.55	4.93	5.30	5.67
Ash	4.97	4.71	4.45	4.19
ME (Kcal/Kg)	2439.37	2495.37	2591.37	2667.37

*Vitamin/mineral premix supplied/Kg of Diet: Vitamin A, 12,500 IU; Vitamin D_3, 2,500 IU; Vitamin E, 30 IU; Vitamin K, 2.5mg; Riboflavin, 6mg; Pantothenic acid, 10mg; Vitamin B, 2mg; Niacin, 30mg; Vitamin B_{12}, 22mg; Biotin, 0.05mg; Folic acid, 1mg; Chlorine chloride, 0.3mg; Antioxidant, 0.125mg; Iron, 100mg; Manganese, 100mg; Zinc, 100mg; Iodine, 1.5mg; Cobalt, 0.5mg; Selenium, 0.1mg and Copper, 10mg.

Materials and Methods

The study was carried out at rabbit unit of Abubakar Tafawa Balewa University Teaching and Research Farm. The area is located within the geographical coordinates of 10^{o} 18' N and 9^{o} 50' E. It is 616 m above sea level with an average annual rainfall of about 1009 mm (19). Four isonitrogenous and isocaloric diets were formulated with palm kernel cake (PKC) replacing wheat offal at 0, 20, 40 and 60 % level of inclusions coded as diets 1, 2, 3 and 4, respectively. Groundnut cake and fish meal were the major protein sources for the experimental diets. Percentage composition and calculated analyses of the diets are shown in Table 1. A total of twenty-four (24) weaner rabbits of mixed breeds and sexes were used for the trial. The experimental animals were sourced from local markets within the Bauchi metropolis. Six (6) rabbits were randomly assigned to each treatment in a completely randomized design. Prior to the onset of the research, the rabbits were allowed to acclimatize to the new environmental condition during which similar feed was fed. The research lasted for 42 days and the experimental diets and water were given *ad-libitum*. The parameters measured from the experimental animals were growth performance, nutrient digestibility and carcass characteristics. Data generated from these measured variables were subjected to analysis of variance (ANOVA) of (20), version 23 (2013) and the means were compared using Duncan Multiple Range Test (DMRT).

Table 2: Growth performance of weaner rabbit fed diets containing graded level of palm kernel cake (PKC) as replacement for wheat offal

	Diet				
Parameters	1	2	3	4	SEM
Initial weight(g)	375.00	421.50	425.00	437.50	69.78^{NS}
Final weight (g)	950.00	1075.00	1237.50	1112.50	81.81^{NS}
Total weight gain (g)	575.00^{c}	662.50^{b}	812.50^{a}	675.00^{b}	83.85*
Weekly weight gain (g)	95.85^{c}	110.40^{b}	135.43^{a}	112.50^{b}	13.97*
Daily weight gain (g)	13.70^{c}	15.75^{b}	19.35^{a}	16.10^{b}	2.00*
Daily feed intake (g)	63.75	62.88	69.93	61.38	5.82^{NS}
Feed conversion ratio	4.65	4.00	3.70	3.85	0.36^{NS}

* = P<0.05, NS = Non-significant and SEM = Standard error of mean

Results

Growth performance of weaner rabbits fed diets containing palm kernel cake as replacement for wheat offal is presented in Table 2. There were no significant differences in the initial live weight (375.00 – 437.50 g), final live weight (950.00 – 1237.50 g), daily feed intake (61.38 – 69.93 g) and feed conversion ratio (3.70 – 4.65). However, daily, weekly and total weight gains were significantly (P<0.05) higher on diet 3 (19.35, 135.43 and 812.50 g, respectively), whereas the least values were recorded on diet 1 (13.70, 95.85 and 575.00 g, respectively). The nutrient digestibility coefficients of rabbits fed graded levels of palm kernel cake as replacement of wheat offal are shown in Table 3. There were no significant differences on dry matter (64.2 – 71.6 %), organic matter 67.3 – 73.5 %), ether extract (89.7 – 94.4 %), acid detergent fibre (46.5 – 56.8) and neutral detergent fibre

(54.4 – 63.3 %) digestibilities. However, significant variation was observed on crude protein digestibility. The values recorded for diets 2 to 4 were similar, but higher than diet 1 (99.6, 99.2 and 98.9 % vs 76.6 %; P<0.05). The results of carcass and organ characteristics (Table 4) revealed that all the parameters measured which include dressing percentage (43.00 – 43.93 %), live (966.70 – 1300 g), pelt (756.70 – 1016.70 g), carcass (406.70 – 566.70 g), skin (7.33 – 8.33 g), leg (2.01 – 2.37 g), head (8,43 – 9.45 g), kidney fat (0.23 – 0.66 g), small intestine (3.98 – 5.53 g), large intestine (7.57 – 9.36 g), heart (0.23 – 0.36 g), spleen (0.040 – 0.043 g), liver (2.20 – 3.72 g), stomach (5.79 – 6.73 g), ceacum (0.44 – 0.56 g) and tail weights (0.31 – 0.43 g) were not influenced by dietary treatments, except for lung weight where significantly higher value was observed on diet 2 which however, did not vary from the values for the group on diet 4, whereas the least was recorded on diet 1 and 2 (0.54 g).

Table 3: Nutrient digestibility (%) of the experimental diets

	Diet				
Parameters	1	2	3	4	SEM
Dry matter	71.6	64.2	69.6	65.9	6.08^{NS}
Organic matter	73.5	67.3	71.5	68.1	5.82^{NS}
Crude Protein	76.6^{b}	99.6^{a}	99.2^{a}	98.9^{a}	5.22^{*}
Ether Extract	89.7	94.4	93.4	91.7	1.70^{NS}
Acid Detergent Fibre	56.8	46.5	53.4	47.1	9.33^{NS}
Neutral Detergent fibre	63.3	54.4	60.2	56.3	7.88^{NS}

* = P<0.05, NS = Non-significant and SEM = Standard error of mean

Table 4: Carcass characteristics of weaner rabbits fed diets containing graded level of palm kernel cake (PKC) as replacement for wheat offal

	Diet				
Parameters	1	2	3	4	SEM
Live weight (kg)	966.70	1033.30	1300.00	1100.00	88.09^{NS}
Pelt weight (kg)	756.70	810.00	1016.70	866.70	73.40^{NS}
Carcass (kg)	406.70	453.30	566.70	483.30	32.91^{NS}
Dressing percentage (%)	43.00	43.93	43.60	43.90	1.71^{NS}
Skin (%)	7.33	8.33	7.79	7.99	0.54^{NS}
Leg (%)	2.01	2.36	2.20	2.37	0.09^{NS}
Head (%)	9.45	8.95	8.43	8.68	0.34^{NS}
Kidney fat (%)	0.23	0.41	0.66	0.48	0.16^{NS}
Small intestine (%)	3.98	5.12	4.00	5.53	0.48^{NS}
Large intestine (%)	7.85	8.52	7.57	9.36	1.01^{NS}
Heart (%)	0.23	0.36	0.23	0.28	0.04^{NS}
Lungs (%)	0.54^{b}	0.77^{a}	0.54^{b}	0.67^{ab}	0.06^{*}
Spleen (%)	0.043	0.043	0.040	0.043	0.004^{NS}
Liver (%)	2.20	3.72	2.43	2.83	0.42^{NS}
Stomach (%)	5.79	6.57	5.85	6.73	1.03^{NS}
Ceacum (%)	0.44	0.55	0.53	0.56	0.09^{NS}
Tail (%)	0.39	0.42	0.31	0.43	0.04^{NS}

* = P<0.05, NS = Non-significant and SEM = Standard error of mean

Discussion

The non-significant variation observed on initial weight support the work of (21) in cross bred rabbits fed varied level of palm kernel cake (PKC) as a replacement of soya beans meal. The authors noticed that live weight of the experimental animals at the onset of the trial was similar. They further reported that other growth performance parameters such as total feed intake, final weight, weight gain and feed conversion ratio were not affected by the dietary treatments. This could be as a result of isonitrogenous and isocaloric nature of the experimental diets (21) used in the trial. Earlier report of (22) showed that rabbits fed graded level of palm kernel cake had similar final live weight and emphasized that this important feed stuff compared favourably with peanut. (23) also reported the absence of significant variation on growth rate, daily feed intake and fat weight of rats fed diet supplemented with 15 – 25 % palm kernel cake.

The significant difference observed on daily weight gain (13.70 – 19.35 g) agrees with the finding of (24) and (25) who reported ranged values of 17.65 – 18.57 g and 14.83 - 16.70 g, respectively. Similarly, (26), (27) and (28) reported significant variation on daily weight gain of rabbits fed varied level of groundnut forage meal and recorded values of 4.94 – 14.80 g, 8.70 – 9.91 g and 10.95 – 16.70g, respectively which is lower than the results obtained in the present study. The non-significant variation observed on final live weight contradicts the findings of (29) on grower rabbits. The authors reported considerable effect of graded level of palm kernel cake as replacement of soya bean meal on final live weight and showed that rabbits fed the control diet (0 % PKC) had the highest value for this parameter when compared to other groups. This suggested the fact that soya bean meal base ration is superior than PKC in the diets of monogastric. Similarly, (30) also reported significant variation on final live weight of weaned rabbit fed graded levels of palm kernel cake. The findings of (31) on broiler chicken fed varying levels of palm kernel cake and maize offal showed that final live weight of the experimental birds varied significantly across the treatment diets. Working on grasscutter fed various level of palm kernel cake as replacement of wheat offal (at 0, 25, 50, 75 and 100 %), (32) reported significant variation on forage intake and average daily weight gain. Higher intake was observed on those fed the control diet, T_2 (25 %) and T_3 (50 %), while the least was recorded T_4 (75 %), while for average daily weight gain, growing rabbits fed 75 % PKC had the highest mean (19.30 g) followed by 50 % PKC and the least being recorded on diet 100 % PKC (-5.0 g). As observed in the present study, the feed conversion ratios of the experimental diets were similar indicating that PKC can replace wheat offal in rabbit diet without any detrimental effect on growth, this however contradicts the investigation made by (28) who reported poor feed utilization of 4.38 – 6.85. Earlier reports of (33) and (34) indicated significant difference on feed conversion ratio of growing rabbits fed varied level of rice offal. Better values of 2.93 to 4.20 were recorded by the latter authors, while the former reported poorer fed utilization of 5.33 – 7.43. (32) reported that better feed conversion ratio was recorded when PKC was fed at 50 % level of inclusion in grasscutter diet. They further explained that the optimum crude protein (12.25 %) and the conducive internal environment created by this diet in the gastro-intestinal tract of the experimental animals resulted in more efficient conversion of fibre to volatile fatty acids (VFAs).

except crude protein (CP) where diet 1 had significantly lower value compared to 2, 3 and 4, the nutrient digestibility coefficients of the experimental diets fed to weaner rabbits revealed that the values for dry matter (DM), organic matter (OM), ether extract (EE), acid detergent fiber (ADF) and neutral detergent fiber (NDF) were not affected by the inclusion of PKC. This is in contrast with the findings of (35) who reported that the inclusion of 10% PKC in broiler starter diet led to a decrease in nutrient digestibility. This could be attributed to high levels of NDF and ADF in the experimental diet (36; 37).

The variations observed on carcass and organ characteristics were not significant. This agrees with findings of (21) who reported that carcass and organ characteristics of cross-bred rabbit were not significantly affected by varied dietary level of palm kernel oil residue. However, the authors reported significant differences on thigh weight which is one of the valuable primal cut cherished by the rabbit farmers and consumers. The dressing percentage reported in the current observation is within the range values of 43.24 - 53.83 % recorded by (38), but lower than 55 – 61 %, 52.05 – 53.36 % and 55.35 – 57.35 % (39; 40; 21), respectively). The variation reported on dressing percentage by several investigators could be attributed to nutrition plane, age, breed, pre-slaughter handling and general health conditions of the experimental animals (41). This supports the earlier report by (42) that nutrition, age, sex, environmental factors, stage of development and efficiency of feed utilization had great effect on carcass quality. (28) reported non-significant effect of diets containing different fiber sources on the primal cuts and organ characteristics of rabbit and related this fact to better utilization of the fibrous ingredient by the experimental animals. (43) also showed that fiber source had no effect on organ characteristics of rabbits.

Contrary to the present finding, (44) detected significant decrease in carcass weight of broiler chickens at all levels of PKC inclusion. Earlier report of (45) also indicated higher liver weights in broilers chickens fed un-supplemented guinea corn/palm kernel-based ration. The work of (10) in growing pigs indicated that carcass (dressing percentage, eye muscle area and back fat thickness) and organ characteristics were significantly influenced by inclusion level of PKC. The author further explained that liver and lungs weights had positive relationship with level of PKC (i.e. the higher the inclusion levels of PKC in the diet of growing pigs, the higher the weight of liver and lungs of the slaughtered animal).

Conclusion and Application

1. The study showed that palm kernel cake (PKC) can replace wheat offal at up to 60 % level of inclusion in the diet of weaner rabbits without affecting performance.
2. Except lung weight, the variations observed on carcass parameters were not significant.

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