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Effects of Feeding Carrot (*Daucus carota L*) Leaf Meal on Haematology, Blood Chemistry and Carcass Characteristics of Growing Rabbits in a Semi-Arid Environment of Borno State of Nigeria

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Abstract: A ten-week experiment was conducted to determine the haematological indices, serum chemistry and carcass characteristics, of growing rabbits fed graded levels of carrot (*Daucus carota L*) leaf meal. A total of 30 rabbits were randomly allocated in groups of six (6) to five dietary treatments with T_1 (control), T_2, T_3, T_4 and T_5 containing 0, 10, 20, 30 and 40% carrot leaf meal respectively. The experimental diets and clean drinking water were supplied to the rabbits *ad libitum*. The analyzed blood parameters showed significant ($p<0.05$) differences except for Mean Corpuscular Haemoglobin Concentration (MCHC) and White Blood Cell (WBC). Packed Cell Volume (PCV) and Haemoglobin (Hb) were generally higher in carrot leaf meal diets than the control diet (T_1). Red Blood Cells (RBC) increased with increase in Carrot Leaf Meal (CLM) while Mean Corpuscular Volume (MCV) decreased with increase in Carrot Leaf Meal (CLM) compared to T_1 (control diet). There were no significant differences ($p>0.05$) for serum biochemical indices among all treatments. The slaughter weight showed significant ($p<0.05$) differences among all treatments with rabbits on T_2 (10% CLM) having the highest slaughter weight (1443.70 g) and T_3 (20% CLM) having the highest dressed weight (1133.30 g). There were no significant ($p>0.05$) differences among the treatments for dressing percentage, head, skin, shoulder, loin, hind legs, liver, lungs and kidneys while the tail, feet, rack, heart and abdominal fat showed significant ($p<0.05$) differences. Based on these results, growing rabbits could tolerate up to 40% carrot leaf meal without adverse effects on their haematological parameters and carcass characteristics.

Key words: growing rabbits feed, carrot (*Daucus carota L*) leaf meal, animal protein

INTRODUCTION

Rabbit is a herbivorous, monogastric and pseudoruminant animal that can effectively and efficiently convert fodder to meat (Lebas, 1980). Rabbit is blessed with unique digestive tract that can convert fibrous materials to animal protein. One of the challenges of animal researchers and nutritionists, is to provide feeding strategies for monogastric animals especially poultry, pigs and rabbits. The strategies should be able to minimize the cost of production and reduce competition between animal and humans for the feed ingredients (Biobaku, 2002).

The nutrition of the rabbits is one of the most important aspects of its production; the non-availability and/or insufficient supply of rabbit pellets which consist mainly of cereal grains hampered their production (Aduku and Olukosi, 1990). The search for alternative sources of energy in rabbit diet has remained a topical issue among animal nutritionist (Igwebuike, 2001). Alternatives worth exploring are the array of agro-industrial by-products which abound in Nigeria (Oluokun and Olaloku, 1999).

The use of forages and other materials such as cassava and maize chaff (Agwunobi and Ibedu, 1996), groundnut shell (Nigam, 1989), cowpea shell (Doma *et al*., 1999) and *Tridax procumbens* leafs (Asuquo, 1997) have been reported in rabbit nutrition. The use of forages in rabbit production is a normal practice. Rabbit producers are advised to feed forages as supplements, to concentrates. Though optimum rabbit production cannot be sustained on forages alone, it is possible to drastically reduce cost of concentrate used by utilizing forages that are nutritious and palatable to achieve a compromise between optimum production and cost that is acceptable to producers. The vast forage species in the tropics have not been properly harnessed for this. Studies on preference of forages by rabbits had been conducted by Aduku *et al*. (1989). However very few forage species have been studied. Carrot leafs should have complementary nutrient composition that could be harnessed in the reduction of feed cost in rabbit production but at the moment there is little or no information on the use of carrot leaf meal for rabbit feeding.

Carrots contain ample quantity of beta-carotene, is a substance that is converted to Vitamin A in the human and animal body. Carrot is also a good source of vitamins B and C as well as calcium pectate, an extra-

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ordinary pectin fibre that has been found to have cholesterol-lowering properties. Carrot is an herbaceous plant containing about 87% water and rich in mineral salts (Anon, 2007).

Carrot leafs contain significant amount of porphyries which stimulate the pituitary gland and lead to the release of increased levels of sex hormones, induce uterine contractions and so should not be used by pregnant animals (Anon, 2007).

Owing to the large percentage of carbohydrate material contained in carrots, rabbits when fed on carrot leafs alone for several days are found to have an increased amount of glycogen stored in their liver-the carrots having been converted into glycogen in their body (Anon, 2007). The objectives of the study are to investigate the effects of carrot leaf meal on blood chemistry and carcass characteristics of growing rabbits.

MATERIALS AND METHODS

Site of experiment: The study was conducted at the Teaching and Research Farm of Ramat Polytechnic Maiduguri, Borno State of Nigeria from February to April 2009. Maiduguri is located between latitude 11°5'' and 12° north and longitude 13° 05'' and 14° east and on an altitude of 354 m above sea level (Alaku, 1983). The mean relative humidity ranges from 30% to 50% with minimum in February to May when it drops to as low as 10% and a maximum of about 90% in August (Ugherughe and Ekedolum, 1986). It falls within the sub-arid zone of West Africa characterised by short duration of rainfall (3-4 months) which varies from 500 mm to 600 mm with long dry season (7-8 months). Ambient temperatures are high during the months of April to June and falls within the range of 40°C and above, while relative humidity at noon ranges from 5-45% (Alaku, 1983).

Sources of carrot leafs: The carrot leafs (*Daucus carota*) were obtained from Ngurosoye, Bama Local Government Area of Borno State, Nigeria. The leafs were properly sun-dried for seven days and bagged.

Experimental stock and management: Thirty (30) rabbits (Dutch X New Zealand White) aged between 5-6 weeks were used. The rabbits were obtained from local producers in Maiduguri town and transported to the farm early in the morning to avoid heat stress. The cages, feeders and waterers were cleaned and disinfected before the arrival of the rabbits. Later the drinkers were washed and the floor swept daily. The rabbits were randomly divided into five groups with six rabbits (6) in each group. Each rabbit was caged individually and provided with drinking water and feed *ad libitum*. The study lasted for 10 weeks with one week adjustment period.

Experimental diets: Five diets were compounded for the experiment. The ingredients used for formulating the diets include ground maize, carrot leaf meal, wheat offal, groundnut haulm, groundnut cake, fish meal. bone meal, common salt and vitamin-mineral premix. Carrot leaf meal was included at the levels of 0, 10, 20, 30 and 40% in diets 1 (control) 2, 3, 4 and 5 respectively as shown in Table 1. The carrot leaf meal replaced maize weight for weight. Each diet was formulated to meet the minimum protein requirement (16 to 18% CP) of growing rabbits.

Data collection

Feed intake: Each rabbit was fed twice daily. A known quantity of feed was given one part in the morning (8.00am) and the last part in the afternoon (4.00pm) and the left-over of feed collected the next day and weighed to determine the daily feed intake.

Table 1: Ingredient composition of the experimental diets

	Levels of inclusion of carrot leaf meal in the diet				
Ingredients (%)	0%	10%	20%	30%	40%
Maize	44.85	34.85	24.85	14.85	4.85
Carrot leaf meal	0.00	10.00	20.00	30.00	40.00
Wheat offal	15.00	15.00	15.00	15.00	15.00
Groundnut haulms	15.00	15.00	15.00	15.00	15.00
Groundnut cake	17.75	17.75	17.75	17.75	17.75
Fish meal	5.00	5.00	5.00	5.00	5.00
Bone meal	2.00	2.00	2.00	2.00	2.00
Salt (NaCl)	0.25	0.25	0.25	0.25	0.25
Premix*	0.15	0.15	0.15	0.15	0.15
Total	100.00	100.00	100.00	100.00	100.00
Calculated analysis					
Crude protein	19.92	20.11	20.32	20.53	21.54
Crude fibre	7.26	9.35	10.63	11.92	13.20
ME (kcal/kg)	2802.45	2742.45	2682.40	2622.84	2562.85

*Premix (vital D_{IZ} B.P) manufactured by Dizpharm (Nig), Lagos supplying the following per kg: Vitamin A, 6,5200,000 IU; Vitamin D_3 1,250,000 IU; Vitamin E, 15,000 IU; Vitamin K, 1250 mg; riboflavin, 3,000 mg; pantothenic acid 5,000 mg; pyridoxine 1,750 mg; Vitamin B_1 1,000 mg; niacin 15,000 mg; Vitamin B_{12} 10 mg; biotin 25 mg; folic acid 500 mg; choline chloride 150 g; antioxidant 62.5 g; iron 50 g; manganese 50 g; zinc 50 g; iodine 0.78 g; cobalt 0.25 g; copper 5.0 g; selenium 0.05 g

Weight gain: The rabbits were weighed at the beginning of the experiment (Initial weight) and weekly thereafter. Weight change in (g) was calculated by difference between two consecutive weighings.

Blood collection: During week eight (8) of the experiment, blood samples were collected from three rabbits in each treatment for blood analysis. Blood samples were collected from the ear veins of the rabbits using sterile disposal syringe and needle. The rabbits were starved overnight and collection done the following morning at about 7.00-8.00 am in order to avoid excessive bleeding. An anti-coagulant, Ethylenediamine Tetra-acetic Acid (EDTA) was used to prevent clotting of the blood for the haematological indices.

Haematological indices: The haematological indices which include Packed Cell Volume (PCV), Red Blood Cell Counts (RBC), White Blood Cell Counts (WBC) and Haemoglobin Concentration (Hb) were measured according to the methods expounded by Bush (1975). PCV, RBC, WBC and Hb were determined by micro-haematocrit, improved Neubauer haemocytometer and cyanomethaemoglobin methods respectively. Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH) and Mean Corpuscular Haemoglobin Concentration (MCHC) were calculated according to standard formulae (Schalm *et al*., 1975):

Serum biochemical indices: The serum biochemical indices which include serum albumin, total protein, globulin, cholesterol, glucose, Calcium (Ca) and Phosphorus (P) were measured according to methods described by Bush (1991). The serum glucose, urea and cholesterol were estimated by orthotoludine, Diacetyl monoxime and colorimetric enzyme methods respectively. The serum total protein and serum albumin were determined by Biuret reactions (Bush, 1975).

Carcass data: At the end of week 10 of the study, three (3) rabbits from each treatment were randomly selected and starved overnight (12 hrs) but water was provided. The next morning, the rabbits were weighed and slaughtered.The dressed carcass, body components and organs were weighed and expressed as percentage of slaughter weight.

Chemical analysis: The chemical analysis of the carrot leaf meal, the experimental diets and faecal samples were carried out according to the AOAC (1980) methods. The crude protein was determined by the Kjedahl procedure while the ether extract and crude fibre were determined by soxhlet extraction and tricholoracetic acid methods respectively. The dry matter was determined by drying samples at 80°C, ash by ashing in the electric furnace at 550°C (for six hours) and Nitrogen-Free Extract (NFE) by difference.

Statistical analysis: All data collected were subjected to Analysis of Variance (ANOVA) (one-way ANOVA) according to Steel and Torrie (1980) using SPSS package (13.0). Least Significant Difference (LSD) was used to separate the treatment means.

RESULTS AND DISCUSSION

Chemical composition of carrot leaf meal and the experimental diets: The chemical composition of experimental diets and carrot leaf (hay) meal are presented in Table 2. The Dry Matter (DM) values of the diets varied from 96.03 (T_4) to 97.97% (T_5). Crude Protein (CP) values varied from 19.69 (T_2) to 20.63% (T_3), Crude Fibre (CF) 5.50 (T_1) to 10.64% (T_5) while Ether Extract (EE) values varied from 4.17 (T_5) to 6.83% (T_1). Ash content was from 2.00 (T_2) to 5.80% (T_5) and Nitrogen-Free Extract (NFE) from 58.76% (T_5) to 66.02% (T_2). The carrot leaf meal contained 97.23% Dry Matter (DM), 12.02% Crude Protein (CP), 14.83% Crude Fibre (CF), 1.33% Ether Extract (EE), 7.58% ash and 64.24% Nitrogen-Free Extract (NFE). The Crude Protein (CP) contents of the diets were close to the 16-18% recommended by NRC (1984); Church (1978); Aduku and Olukosi (1990) for growing rabbits but the Crude Protein (CP) of 12.02% of the carrot leaf meal was higher than 9.0% crude protein in many leafs reported by FAO (1986).

The Ether Extract (EE) values of 4.17 to 6.83% recorded in this study were higher than the values (3.95 to 4.5%) reported by Maigandi and Abdullahi (2003) who fed morning glory forage to weaner rabbits. The EE values of 4.17 to 6.83% in the diets of the rabbits were, however, similar to those of Cheeke (1979) and King (1978) who reported that a minimum level of 3% fat is desirable to provide essential fatty acids and therefore adequate to meet the needs of growing rabbits. Also, the Ether Extract (EE) values in this study were higher than the values of 1.19 to 1.85% reported by Erakpotobor *et al*. (2007) who included varying levels of groundnut haulms in the diet of weaner rabbits.

The Metabolizable Energy (ME) levels of the diets were 3568.60, 3517.74, 3431.65, 3345.61 and 3187.06 kcal/kg for diets 1 (Control), 2, 3, 4 and 5 containing 0, 10, 20, 30 and 40% dried carrot leaf meal respectively. The Metabolizable Energy (ME) levels in all the diets decreased as the level of carrot leaf meal increased up to 40% (T_5). The decrease in Metabolizable Energy (ME) with increasing levels of carrot leaf meal may be attributed to the lower metabolizable energy of carrot leaf meal (2832.99 kcal/kg) compared to 3730.00 kcal/kg ME of maize grain reported by Gohl (1981). The energy levels of the diets were, however, higher than the 2500.00 and 2800.00 kcal/kg ME levels respectively recommended by Aduku and Olukosi (1990); Anugwa *et al*. (1982) for growing rabbits. From these results, therefore, all the diets formulated met the minimum levels of ME, CP, CF and EE recommended by NRC (1984) for growing rabbits.

Table 2: Chemical composition of the experimental diets and carrot leaf meal

Constituents (%)*	Levels of inclusion of carrot leaf meal in the diet 0%	10%	20%	30%	40%	Dry carrot leaf meal
Dry Matter (DM)	96.33	96.07	96.37	96.03	97.97	97.23
Crude Protein (CP)	19.89	19.69	20.00	20.32	20.63	12.02
Crude Fibre (CF)	5.50	6.79	8.07	9.36	10.64	14.83
Ether Extract (EE)	6.83	5.50	5.40	4.50	4.17	1.33
Ash	2.57	2.00	3.03	3.00	5.80	7.58
Nitrogen-Free Extract (NFE)	65.77	66.02	63.50	62.82	58.76	64.24
ME (kcal/kg)**	3568.60	3517.74	3431.65	3345.61	3187.06	2832.99

*These values are means of 3 determinations. **Metabolizable Energy = ME (kcal/kg) = 37 x % CP + 81 x % EE + 35.5 x % NFE calculated according to the formula of Pauzenga (1985)

Table 3: Haematological indices of rabbits fed graded levels of carrot leaf meal

Parameter	Levels of inclusion of carrot leaf meal in the diets 0%	10%	20%	30%	40%	SEM
Haematocrit, PCV (%)	22.00^{b}	41.00^{a}	40.67^{a}	39.33^{a}	36.33^{ab}	6.29*
Haemoglobin (Hb.g/100 ml)	10.67^{b}	12.70^{a}	13.53^{a}	13.07^{a}	12.10^{ab}	0.87*
RBC ($x10^6$/mm^3)	5.03^{bc}	4.50^{c}	5.33^{b}	5.13^{ab}	5.87^{a}	1.02*
WBC ($x10^3$/mm^3)	4.87^{a}	6.10^{a}	3.77^{a}	4.17^{a}	3.60^{a}	0.33^{NS}
MCV (fl)	63.62^{c}	91.11^{a}	76.92^{b}	76.66^{b}	61.19^{c}	4.32*
MCH (Pg)	21.27^{c}	28.22^{a}	25.33^{b}	29.93^{a}	20.44^{c}	2.12*
MCHC (%)	33.00	30.96	32.93	33.31	33.31	3.26^{NS}

NS = Not significant (p>0.05); a,b,c, = means in the same row bearing different superscripts differ significantly (p<0.05); PCV = Packed Cell Volume; WBC = White Blood Cell, RBC = Red Blood Cell; MCV = Men Corpuscular Volume; MCH = Mean Corpuscular Haemoglobin; MCHC = Mean Corpuscular Haemoglobin Concentration; SEM = Standard Error of Mean; *Significant (p<0.05)

Haematological indices: The results of the haematological indices are presented in Table 3. There were no significant differences (p>0.05) among treatments for White Blood Cell (WBC) and Mean Corpuscular Haemoglobin Concentration (MCHC). The Packed Cell Volume (PCV) was better in the groups receiving 10, 20 and 30% carrot leaf meal than the control (0% leaf meal). The values for PCV (22.00 to 41.00%), within the range of 31 to 38% reported by Kamal-Shar *et al*. (2007). The carrot leaf meal treated diets had significantly (p<0.05) higher Haemoglobin (Hb) concentration compared to the control. However, the values did not differ (p>0.05) between the 40% CLM and the control diets. The values were close to the range of 10.67 to 12.60 g/dl reported by Njidda *et al*. (2006) for growing rabbits fed molasses. The results showed that the nutrient content of the experimental diets that met the rabbit's nutritional requirements. Adejumo (2004) reported that haematological traits especially PCV and Hb were correlated with the nutritional status of the animal.

The Red Blood Cell Count (RBC) showed significant differences (p<0.05) among treatments. The highest value was recorded in T_5 but there was no differences (p>0.05) between T_5 and T_4 as well as among T_4, T_3 and T_1. The lowest RBC value was in T_2. The values, (4.50 to 5.87 x 10^6/mm^3), were within the ranges of (3.8 to 7.9 x 10^6/mm^3) (Anonymous, 2004) and 3.07 to 7.50 x 10^6/mm^3 (Fudge, 1999) reported for RBC in rabbits, but T_5 (5.87) had the highest value while T_2 (4.50) the lowest. Hacbath *et al*. (1983) opined that increased RBC values was associated with high quality dietary protein and with disease-free animals. Shakoori *et al*. (1990) on the other hand, suggested that decrease in RBC counts was either an indication of excessive damage of erythrocytes or inhibition of erythrocyte formation in rabbits. The values of the White Blood Cell (WBC) count showed no significant difference (p>0.05) among treatments.

The WBC counts which ranged from 3.77 to 6.10 x 10^3/mm^3 were close to the range of 4.80 to 7.20 x 10^3/mm^3 reported by Njidda and Hambagda (2006) for growing rabbits in semi-arid area. The results indicate that the animals remained healthy because decrease in number of WBC below the normal range is an indication of allergic conditions, anaphylactic shock and certain parasitism or presence of foreign body in circulating system (Ahamefule *et al*., 2008). None of these was observed in this study.

The values for MCV was higher in T_2 (91.11fl) than the other treatment groups while MCH was higher in T_4 (30% CLM) than the other treatment groups, though there was no significant difference (p>0.05) between T_2 (10% CLM) and T_4 (30% CLM). This may be due to the negative interaction between protein and energy levels in the diets. Johnson-Delaney (1996) explained that the MCV and MCH values could reflect anaemic condition and the capacity of the bone marrow to produce RBC of normal size and metabolic capacity. Barger (2003) also reported that any increase in MCV, MCH and decrease in MCHC of rabbit above or below the normal range

Table 4: Serum biochemical indices in rabbits fed graded levels of carrot leaf meal

	Levels of inclusion of carrot leaf meal in the diets					
Parameters	0%	10%	20%	30%	40%	SEM
Total protein (g/dl)	4.40	5.47	5.16	5.40	5.13	0.16^{NS}
Albumin (g/dl)	2.87	3.57	3.56	3.13	3.76	0.14^{NS}
Globulin (g/dl)	1.53	1.90	1.60	2.27	1.37	0.13^{NS}
Glucose (mg/dl)	49.30	47.30	44.70	46.00	42.00	0.03^{NS}
Cholesterol (mg/dl)	47.00	66.00	56.07	55.00	61.00	0.03^{NS}
Blood urea (mmol/L)	3.63	5.07	3.83	4.50	5.10	0.06^{NS}
Calcium (mg/dl)	1.77	2.10	1.73	2.13	1.77	0.01^{NS}
Phosphorus (mg/dl)	1.17	0.93	0.97	0.83	0.63	0.01^{NS}

SEM = Standard Error Mean; NS = Not Significant (p>0.05)

indicate macrocytic and hypochronic anaemia, probably due to the increased activity of bone marrow and deficiency of some haemopoietic factors which are useful index of the capacity of bone marrow to produce red blood cells (Awodi *et al*., 2005). However, MCHC is very significant in the diagnosis of anaemia. These are also referred to as RBC indices. There was no negative effect of carrot leaf meal inclusion on RBC up to 40%,since all the RBC values were within normal range. The higher values observed for MCV and MCH in T_2 however, may not pose a serious problem since PCV, RBC, WBC and MCHC in all the treatments were within the normal ranges for healthy rabbits.

Serum biochemical indices: The serum biochemical indices in rabbits fed graded levels of Carrot Leaf Meal (CLM) are presented in Table 4. There were no significant treatment effect on the serum biochemical's observed. The values for albumin and total protein ranged from 2.87 to 3.76 g/dl and 4.40 to 5.47 g/dl respectively. These values were close to the normal values of 2.5 to 4.0 g/dl reported by Anon (2004) for albumin and 5.0 to7.5 g/dl for total protein by Onifade and Tewe (1993). Similarly, the globulin values 1.37 to 2.27 g/dl were within the ideal range of 1.5 to3.3 g/dl reported by Anon (2004). Abnormal serum albumin usually indicates an alteration of normal systematic protein utilisation (Apata, 1990) and low dietary protein intake (Onifade and Tewe, 1993). This observation was corroborated by Awosanya *et al*. (1999) who demonstrated the dependence of blood protein on the quality and quantity of dietary protein. The normal values for albumin, total protein and globulin obtained in this study indicated nutritional adequacy of the diets for rabbits.

The blood glucose values ranged from 42.00 to 49.30 mg/dl. The higher values observed in T_1 (49.30 mg/dl) may not pose any problem since Flurharty and Loerch (1996) reported that high energy do not have any detrimental effects on the health of the animals, but rather increases their growth rate in the tropics. According to Mayes (1996), a continuous supply of glucose is necessary as a source of energy especially for the nervous system and the erythrocyte. Moreover, the normal range of blood sugar level obtained for rabbits in this study showed that the animals were not surviving at the expense of body tissues (Ologhobo *et al*., 1992).

The blood cholesterol values ranged from 47.00 to 66.00 mg/dl. The values fall within the 3.8 to 8.00 mmol/L reported by Njidda *et al*. (2006) who fed molasses to rabbits in the same environment. The slight difference can be attributed to individual physiological variation of the animals. The urea values ranged from 3.63 to 5.10 mmol/L with the lowest and highest values in T_1 (0%CLM) and T_5 (40%CLM) respectively. The blood urea values were lower than those reported by Anon (2004), but similar to the values reported by Njidda *et al*. (2006) who fed rabbits using molasses as energy source in a tropical environment. Bush (1991) reported that decreased blood urea might be associated with severe liver disease or protein malnutrition. Since there was no sign of ill-health observed in the rabbits and the protein levels in the diets were within the recommended levels, the possible explanation could be due to environmental factor. Blood urea concentration was also normal among treatment groups. Increase in serum urea concentration may suggest an increase in activities of urea enzymes orninthine carbamoyl transferase and arginase which may also indicate kidney damage (Ajagbonna *et al*., 1999).

Carcass characteristics: The results of the carcass characteristics measurements are shown in Table 5. There were significant differences (p<0.05) among treatments for slaughter weight, carcass weight and ribs expressed as percentage of slaughter weight. The organ weights (Table 5) showed significant difference (p<0.05) for heart and abdominal fat. liver, lungs and kidneys were similar in all the treatments.

The dressing percentage ranged from 40.04 to 45.66% with the highest value for T_3 (45.66%) and lowest for T_5 (40.04%). The values were generally lower than the range of 50-60 reported by Fielding (1991) who further stated that the dressing percentage will tend to be 50% or less if the rabbit is young, thin and with a full digestive tract at killing. This might be the possible reason why the dressing percentage was low. On the average, the relative weight of the shoulder (forelegs) appears to be

Table 5: Carcass data of rabbits fed graded level of Carrot Leaf Meal (CLM)

	Levels of inclusion of carrot leaf meal in the diets					
Parameters	0%	10%	20%	30%	40%	SEM
No. of rabbits slaughtered	3.00	3.00	3.00	3.00	3.00	-
Slaughter weight (g)	1338.30^{a}	1443.70^{a}	1391.70^{a}	1385.00^{a}	1051.70^{b}	78.67*
Weight of dressed carcass (g)	1108.30^{a}	1116.70^{a}	1133.30^{a}	1100.00^{a}	700.00^{b}	109.25*
Dressing percentage (%)	40.10	41.54	45.66	44.75	40.04	5.44^{NS}
Body component expressed as percentage of slaughter weight (%)						
Head	9.55	7.64	8.60	8.86	9.11	1.11^{NS}
Skin	5.96	7.57	6.08	7.52	5.52	1.23^{NS}
Tail	57.00^{ab}	47.00^{ab}	0.56^{ab}	0.81^{a}	0.61^{ab}	0.11*
Feet	0.69^{b}	0.72^{b}	0.64^{b}	0.72^{b}	0.89^{a}	0.07*
Shoulder/foreleg	7.72	58.53	8.54	8.59	7.91	1.17^{NS}
Rack/Ribs	10.73^{a}	8.36^{b}	9.24^{b}	8.20^{ab}	7.27^{b}	1.19*
Loin	7.58	10.38	11.20	11.64	9.92	2.57^{NS}
HindLegs	16.02	15.19	16.68	16.31	14.95	1.48^{NS}
Organ weight expressed as percentage of slaughter weight (%)						
Heart	0.22^{b}	0.33^{a}	0.27^{c}	0.28^{ab}	0.28^{ab}	0.04*
Liver	2.46	2.42	2.25	2.59	2.42	0.28^{NS}
Lungs	0.77	0.55	0.71	0.82	0.64	0.13^{NS}
Kidneys	0.60	0.64	0.68	0.66	0.74	0.09^{NS}
Abdominal fat	1.06^{a}	1.17^{a}	1.34^{a}	0.79^{ab}	0.43^{b}	0.24*

a,b,c = Mean values on the same row with different superscripts are significantly different ($p<0.05$); NS = Not Significant ($p>0.05$); SEM = Standard Error of the Means

inferior compared to the thigh (hindlegs). This may be attributed to the late maturing characteristics of the forelegs especially the scapular regions (Ijaiya and Fasanya, 2004). The abdominal fat was lower in T_5 (0.43%) than the other treatment groups. This may be due to lower slaughter weight of rabbits in T_5 (40% CLM).

Values obtained for kidneys and liver weights (Table 5) in this study showed no significant difference ($p>0.05$) among treatment groups. It is a common practice in feeding trials to use weights of some internal organs like liver and kidney as indicators of toxicity. Bone (1979) reported that if there is any toxic elements in the feed, above threshold level, abnormalities in weights of liver and kidney would be observed. The abnormalities will arise because of increased metabolic rate of the organs in attempt to reduce these toxic elements or anti-nutritional factors to non-toxic metabolites.

The liver and kidney weights in the rabbits in this suggests that the test diets did not contain any appreciable toxin. This observation is corroborated by Ekpo *et al.* (2009) who observed no significant difference ($p>0.05$) among treatments for lungs, kidney and liver of rabbits fed cassava leaf meal. This observation therefore indicates that carrot leaf meal is a safe feed for rabbits.

Conclusion: From these results it can be concluded that growing rabbits could tolerate up to 40% replacement of maize with carrot leaf meal in their diets without adverse effects on blood components and carcass characteristics.

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