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RESPONSE OF BROILER FINISHER CHICKENS TO DIETARY INTAKE OF CASSAVA LEAF MEAL

Esiegwu, A. C, Nwaba, A

Department of Animal Science and Fisheries, Imo State University, Owerri
Corresponding Author's E-mail: arthuresiegwu@yahoo.com

ABSTRACT

The response of dietary intake of cassava leaves meal on broiler finisher chickens was investigated. The cassava leaf meal (CLM) was used to formulate five broiler finisher diets at 0%, 2.5%, 5.0%, 7.5% and 10% inclusion levels partly replacing soya bean meal in the diet. The diets were represented as T_1 (0%), and T_2 (2.5%). T_3 (5.0%), T_4 (7.5%), and T_5 (10%) respectively. Seventy-five (75) broiler finisher chickens were divided into five treatment groups of fifteen (15) birds each in a Completely Randomized Design (CRD). Each treatment group was further divided into three replicates of five birds per replicate and each of the groups was assigned to one of the treatment broiler finisher diets and fed for 28 days. Data were collected on body weight changes, feed intake, and feed conversion ratio. At the end of the feeding trial, three birds were randomly selected from each treatment (one per replicate) and used for evaluation of the carcass and internal organ weight. Three birds per treatment were also separated and put in an individual metabolic cage for total tract faecal collection. Economic parameters determined were cost/kg weight gain, cost of total feed consumed, and gross margin. Statistical analysis data on the performance result showed that T_1 (0%) and T_2 (2.5%) inclusion levels were significantly better $P<0.05$ than T_3 (5.0%), T_4 (7.5%) and T5 (10.0%) for average weight changes and average daily weight gain. Performance of broilers declined as the inclusion levels of cassava leaf meal increased from 5% to 10%. Feed intake was similar across treatments. Feed conversion ratio revealed that T_1 (0%), T_2 (2.5%), and T_3 (5.0%) were similar in performance but the efficiency of feed utilization clearly demonstrated that 0% and 2.5% inclusion levels gave the optimum performance inclusion levels. Data on the cost and returns of broiler finisher birds offered dietary cassava leaf meal showed that feed cost per kg weight gain was lowest at 2.5% inclusion level of cassava leaves meal T_2 (2.5%). Gross margin (profit) was best or highest at T_2 (2.5%) followed by the control T_1 (0%). 5%, 7.5%, and 10% inclusion levels representing T_3, T_4, and T_5 indicated negative profit margin which means that cost of production was higher than the revenue. There was no treatment effect ($P>0.05$) on the live weight, dressed weight, hearts, and the length of intestines of the chickens. The weights of the thigh, the wings, the breast, the drumstick, the shank, the back, the liver, and the gizzard were statistically similar ($P>0.05$) to the control. This implies that there was no negative effect of the cassava leaves meal on the carcass cuts and organ weights of the chickens. Percentage crude protein digestibility was significantly decreased ($P<0.05$) at T_3 (5.0%), T_4 (7.5%), and T_5 (10%) cassava leaves meal inclusion compared to T_1 (0%) and T_2 (2.5%). The percentage of carbohydrate digestibility was significantly increased ($P<0.05$) at T_4 (7.5%) and T_5 (10%) Cassava leaves meal inclusion compared to T_1 (0%), T_2 (2.5%) and T_3 (5.0%). It was therefore concluded that cassava leaves meal could serve as a protein source partly replacing soya bean meal in broiler finisher ration at not more than 2.5% inclusion level.

Keywords: *Response, cassava leaves, broiler finisher, cost and returns*

INTRODUCTION

The rise in population of Nigeria and the world at large exerts additional pressure to increase food supply which consequentially increases the protein needs of the people. It is known that poultry meat is one of the major sources of meeting the protein needs of the masses and especially their animal protein needs. The effort to increase protein supply demands expansion of the poultry industry. The growth of the poultry industry has been marred over the years by high cost of energy and protein ingredients especially maize, soya bean meal and groundnut cake which are the key sources of these nutrients. Protein in the life of the chicken is necessary for growth, production, reproduction and for other metabolic and biochemical processes that take place in the animal body. Protein is a dietary essential. Protein ingredients are very expensive and these affect the final cost of production leading to high purchasing price of protein products by the consumers. This high cost has negatively led in several ways to poultry industries folding or going out of production, reduction in scale of production and low demand and supply for poultry products. In the light of the above, it becomes necessary to search inwards into some alternative protein sources that are not competing with human use or industrial use to partially or wholly be of value in the poultry feeding to replace soya bean and groundnut cake as protein sources.

Abu *et al*. (2015) reported that soya bean meal and maize respectively, could be replaced by up to 20% inclusion of cassava leaf meal and 20% cassava peelings in the diets of both broiler starter and finisher rations without any deleterious effect on growth and carcass yield of broilers. It was reported that cassava leaves meal at 5% inclusion level could be used in broiler finisher ration without any deleterious effect (Iheukwumere *et al*., 2008). Cassava plant has been known to yield about 10 – 30 t/ha of leaves that has been wasted or used as manure (Bokanga, 1994). Cassava leaves are rich in protein but low in sulfur amino acids (Gomez *et al*., 1985, Phuc *et al*., 2000). Abu *et al*. (2015) reported that cassava leaf meal contains 25.37% crude protein, 11.17% ether extract, 8.47% ash, 10.63% crude fibre and 73.00% total carbohydrate. Similarly, Iheukwumere *et al.* (2008) reported the chemical composition of cassava leaf meal to be 25.30% dm, 25.10% crude protein, 11.40% crude fiber, 12.70% ether extrct, 46.10% nitrogen free extract and 9.10%ash. Despite the huge nutritional quality of cassava leaf meal, it contains some phytochemicals and anti-nutrients. Ogbuji and David-Chukwu (2016) reported that cassava leaf meal contains between 26.03-38.33 mg/100mg alkaloid, 48.07-58.94 mg/100g flavonoid, 1.58-1.65 mg/100g saponin, 0.49-0.57 mg/100g cyanogenic glycosides and 0.45-0.71 mg/100g tannin content. The antinutrients composition were oxalate 29.32-35.77 mg/100g, phytate 1.95-2.17 mg/100g, cyanide 31.48-35.77 mg/100g, and trypsin inhibitor in the range of 0.48-0.72 mg/100g.

This research therefore, was to evaluate the response of broiler finisher chickens to dietary intake of cassava leaves meal.

MATERIALS AND METHODS

This experiment was carried out at the Poultry unit of Teaching and Research farm, Imo State University Owerri, which is located within the South-Eastern agro-ecological zone of Nigeria. Owerri lies between latitude $5^0$29"N and longitude $7^0$20"E. It is almost 91m above sea level with annual rainfall, temperature and relative humidity ranging from 1500mm-2200mm, 20.0-27.50C and 75-90% respectively (Accuweather, 2015). The cassava leaves used for this experiment were harvested from the cassava section of Imo victory cooperative farms, Ezioha, Eziama-Obiato in Mbaitoli L.G.A of Imo state. The leaves were chopped for faster and effective drying on a mat floor. The chopped leaves were sun-dried for three (3) days until they became crispy while still retaining the greenish coloration. The leaves were turned regularly to prevent uneven drying and possible decay of the leaves. The dried leaves were then milled

using a hammer mill to produce cassava leaf meal (CLM). A sample of the leaf meal was taken to the laboratory for proximate and phytochemical analysis according to AOAC, (2010).
The cassava leaves meal (CLM) were used to formulate five broiler finisher diets at 0%, 2.5%, 5.0%, 7.5% and 10% inclusion levels partly replacing soya bean meal in the diet. The diets were represented as T_1 (0%), T_2 (2.5%). T_3 (5.0%), T_4 (7.5%) and T_5 (10%) respectively. The experimental diet and calculated nutrient composition of the experimental broiler finisher diet is presented in Tables 1.

Table 1: Ingredients and calculated nutrient composition of the experimental broiler finisher diet

Ingredients	T_1 (0%)	T_2 (2.5%)	T_3 (5.0%)	T_4 (7.5%)	T_5 (10%)
Maize	55.68	55.68	55.68	55.68	55.68
Soya bean meal	15.47	12.97	10.47	7.97	5.47
Cassava leaf meal	0.00	2.50	5.00	7.50	10.00
Groundnut cake	7.00	7.00	7.00	7.00	7.00
Fish meal	2.00	2.00	2.00	2.00	2.00
Blood meal	1.00	1.00	1.00	1.00	1.00
Palm kernel cake	8.00	8.00	8.00	8.00	8.00
Wheat offal	5.00	5.00	5.00	5.00	5.00
Palm oil	1.00	1.00	1.00	1.00	1.00
Bone meal	4.00	4.00	4.00	4.00	4.00
Salt	0.25	0.25	0.25	0.25	0.25
Vitamin premix	0.25	0.25	0.25	0.25	0.25
Lysine	0.20	0.20	0.20	0.20	0.20
Methionine	0.15	0.15	0.15	0.15	0.15
Total	100	100	100	100	100
Calculated Nutrient Composition					
Crude protein	20.00	20.00	19.36	19.10	19.00
ME(Kcal/Kg)	2909.14	2907.97	2906.80	2905.65	2904.45
Calcium	1.60	1.58	1.57	1.57	1.57
Phosphorus	1.13	1.10	1.06	1.06	1.05
Lysine	0.91	0.84	0.77	0.71	0.64
Methionine	0.43	0.36	0.35	0.35	0.34
Ash	3.12	3.15	3.17	3.20	3.22
Crude fibre	4.19	4.87	5.56	6.25	6.92
Lipid	4.38	4.29	4.21	4.12	4.03

Seventy-five day old broiler chicks were purchased from a certified poultry vendor in Owerri. The chicks were brooded together for four weeks. Thereafter, the birds were divided into five treatment groups of fifteen (15) birds each in a Completely Randomized Design (CRD). Each treatment group was further divided into three replicates of five birds per replicate and kept in a deep litter compartment of 1m x 1m. Each of the groups was assigned to one of the treatment broiler finisher diet. Water and feed were given ad libitum. The necessary routine vaccinations and medications were given as when due. The trial lasted for 28 days. The birds were weighed at the beginning of the trial to obtain their initial body weight. Thereafter, the weighing was done on weekly basis. Daily feed intake was determined by subtracting the weight of the leftover feed from the weight of the initial feed given. Data were collected on feed intake and body weight changes. Also feed conversion ratio was calculated by dividing the average daily feed intake by average daily weight gain.
At the end of the feeding trial, three birds were randomly selected from each treatment (one per replicate) and used for evaluation of the carcass and internal organ weight. The birds were starved of feed overnight and then slaughtered by severing the jugular vein with sharp knife after they have been weighed. The live weight and dressed weight were recorded and internal

organs (liver, heart and gizzard) and length of intestine were recorded and expressed as percentage of live weight.

Three birds per treatment were also separated and put in an individual metabolic cage for total tract faecal collection. The birds were fed known amount of feed and water for seven days. Faecal materials were collected from the third day to the seventh day, consecutively. It was collected whole and dried at 105^{0}C and weighed for each chicken. Thereafter a portion of the faecal materials and feed for each treatment were sent to the laboratory for proximate composition analysis according to AOAC (2010). Nutrient retention on the diet and faeces were calculated using the weight of diet consumed and faecal material excreted and collected and their determined composition. Data collected were subjected to analysis of variance using the SPSS Software (2012). Where analysis of variance indicated significant treatment effects, means were separated using Duncan New Multiple Range Test (DNMRT) (SPSS, 2012).

Economic parameters determined were average weight changes, average daily weight gain, average daily feed intake, cost/kg weight gain, cost of total feed consumed. Cost of production (#) = Cost/Kg weight gain multiplied by average weight changes. Price/Kg meat (#) = Price of selling one Kg of meat. Revenue (#) = Price/Kg meat multiplied by average weight changes. Gross margin (gain/ profit) = Revenue minus cost of production.

Results

The result of the proximate composition of the cassava leaf meal (CLM) is shown in Table 2. The result revealed that cassava leaf meal contains proteins, carbohydrate, energy, fat and high fibre content.

Table 2: Proximate and phytochemical composition of cassava leaf meal (CLM)

Parameters	DM (%)
Moisture	7.30
Protein	33.25
Crude fibre	33.79
Lipid	10.40
Ash	7.03
Nitrogen free extract	8.23
ME Kcal/Kg	2373.14

The results of the performance characteristics of broiler finisher birds offered dietary cassava leaf meal are shown in Table 3. The average body weight gain, average daily weight gain, feed conversion ratio and efficiency of feed utilization showed significant treatment effect (P<0.05). T_1 and T_2 were significantly increased compared to T_3, T_4 and T_5 (5%, 7.5% and 10% inclusion level) for average body weight gain and average daily weight gain respectively. T_1, T_2 and T_3 were significantly decreased (P<0.05) compared to T_4 and T_5 for feed conversion ratio. Conversely, efficiency of feed utilization showed that T_1 and T_2 were significantly increased (P<0.05) compared to T_3, T_4 and T_5. There was no treatment effect (P>0.05) on the average final weight and average daily feed intake.

Table 3: Performance characteristics of broiler finisher birds offered dietary cassava Leaf meal

Parameters	T_1	T_2	T_3	T_4	T_5	SEM
Average initial weight (g)	1069.00	956.13	1023.33	1156.47	1159.33	54.05
Average final weight (g)	1650.00	1552.67	1450.00	1460.00	1406.67	65.38
Average body weight gain (g)	581.00^a	579.87^a	426.67^b	302.87^{bc}	247.34^c	34.51
Average daily weight gain (g)	20.75^a	20.08^a	15.24^c	10.85^d	8.83^d	1.18
Average daily feed intake (g)	114.37	113.25	114.49	128.74	110.56	7.72
Feed conversion ratio (g)	5.54^b	5.50^b	7.90^b	12.23^a	12.52^a	0.99
Efficiency of feed utilization (g)	0.18^a	0. 18^a	0.13^b	0.09^{bc}	0.08^c	0.01

Abcd means within the same row with different superscripts are significantly different (P<0.05

Data on the cost and returns of broiler finisher birds offered dietary cassava leaf meal are shown in Table 4. Feed cost was highest at T_1 (0%) due to high cost of soya bean and decreasing with increasing inclusion of cassava leaf meal. Cost per kg weight was highest at 7.5% inclusion level of cassava leaf meal T_4 (7.5%) due to poor feed conversion efficiency. This means that it cost more to produce 1kg of meat. Similarly feed cost per kg weight gain was lowest at 2.5% inclusion level of cassava leaf meal T_2 (2.5%) due to better feed conversion efficiency compared to the control and other treatments. Cost of feed consumed was lowest at 2.5% inclusion level and highest at 7.5% inclusion level of cassava leaf meal respectively. High meat yield and low cost per kg weight gain for T_2 was responsible for the low cost of feed consumed. Inversely, poor meat yield and high cost per kg weight gain resulted in high cost of feed consumed for T_4. Revenue generated from sales of meat was highest at T_1 (0%) due to heavier weight gain and lowest at T_5 (10%) due to poor weight gain. Gross margin (profit) was best or highest at T_2 (2.5%) followed by the control T_1 (0%) due to low cost of production (cost of feed consumed), reduced cost per kg weight gain and heavier body weight gain. 7.5% and 10% inclusion level representing T_4 and T_5 indicated negative profit margin which means that cost of production was higher than the revenue.

Table 4: Cost and returns of broiler finisher birds offered dietary cassava leaf meal.

Parameters	T_1 (0%)	T_2 (2.5%)	T_3 (5%)	T_4 (7.5%)	T_5 (10%)
Feed cost	300	292.5	285	277.5	270
Cost/Kg weight gain	1662	1608.75	2251.5	3393.83	3361.5
Cost of feed consumed	965.62	932.87	960.65	1027.89	835.90
Cost of production	965.62	932.87	960.65	1027.89	835.90
Price/Kg meat	2500	2500	2500	2500	2500
Revenue	1452.5	1449.68	1066.68	757.18	621.68
Gross margin	486.88	516.81	106.03	-270.71	-214.22

Note: selling price / Kg Meat is ₦2500

Data on the carcass characteristics and internal organ weight of finisher broiler birds offered cassava leaf meal are shown in Table 5. The carcass showed significant treatment effect ($P<0.05$) across treatments. The live weight did not show any significant treatment effects ($P>0.05$) T_1, T_2, T_3, T_4 and T_5 were significantly the same. Dressed weight and percentage dressed weight were statistically the same. T_1, T_2, T_3, T_4 and T_5 were similar ($P>0.05$) statistically. The breast showed treatment effect ($P<0.05$). T_1, T_2, T_4 and T_5 were similar ($P>0.05$). In the same vein T_2, T_3, T_4 and T_5 were statistically similar ($P>0.05$). T_3 were significantly decreased compared to T_1. The thigh did not show any significant treatment effect ($P>0.05$). The drumstick revealed that T_1, T_2, T_4 and T_5 were similar ($P>0.05$). T_4 and T_5 were increased significantly compared to T_3. The wings showed that T_1, T_2, T_3 and T_5 were the same ($P>0.05$). T_4 was significantly increased ($P<0.05$) compared to T_3. The shank revealed that T_1, T_2, T_3 and T_5 were the same just as T_1, T_3, T_4 and T_5 were the same ($P>0.05$) statistically. T_4 was significantly increased compared to T_2. The back showed that T_1, T_2, T_3, and T_4 were statistically similar ($P>0.05$). T_5 was significantly increased ($P<0.05$) compared to T_3. The heart did not show any significant difference ($P>0.05$) across treatments. The gizzard had no significant treatment effect ($P>0.05$) for T_1, T_2, T_4 and T_5. T_3 was significantly decreased ($P<0.05$) compared to T_2, T_4 and T_5. The intestinal length did not reveal any significant treatment effect.

Table 5: Carcass characteristics of broiler finisher chickens offered cassava leaf meal

Parameters	T_1	T_2	T_3	T_4	T_5	SEM
Live weight (g)	2066.67	2100.00	2200.00	2000.00	1700.00	163.30
Dressed weight (g)	1366.67	1266.67	1200.00	1300.00	1133.33	150.00
Dressed weight (%LW)	65.67	60.00	54.33	64.67	64.67	3.83
Head (%LW)	2.17^{b}	2.27^{b}	2.23^{b}	2.93^{a}	2.57^{ab}	0.12
Neck (%LW)	3.63	3.80	3.10	4.17	3.47	0.29
Breast (%LW)	17.67^{a}	15.33^{ab}	11.97^{b}	14.80^{ab}	16.57^{ab}	1.35
Thigh (%LW)	11.70	10.23	8.90	14.43	10.13	0.93
Drumstick (%LW)	9.57^{ab}	8.70^{ab}	8.00^{b}	10.13^{a}	10.40^{a}	0.52
Wing (%LW)	7.23^{ab}	7.27^{ab}	6.87^{b}	8.47^{a}	7.80^{ab}	0.37
Wing (%LW)	7.23^{ab}	7.27^{ab}	6.87^{b}	8.47^{a}	7.80^{ab}	0.37
Shank (%LW)	3.60^{ab}	3.43^{b}	3.37^{ab}	4.50^{a}	3.73^{ab}	0.25
Back (%LW)	19.80^{ab}	18.67^{ab}	16.30^{b}	19.00^{ab}	21.33a	0.99
Liver (%LW)	1.90^{b}	2.20^{ab}	2.37^{ab}	2.70^{a}	2.17^{ab}	0.14
Heart (%LW)	0.43	0.43	0.33	0.50	0.40	0.05
Gizzard (%LW)	2.17^{ab}	2.43^{a}	1.77^{b}	2.40^{a}	2.43^{a}	0.16
Intestine Length (%LW)	305.67	299.67	305.33	324.67	299.67	16.46

(%LW) means percentage Lives weight.

Data on the coefficient nutrient digestibility and percentage nutrient digestibility are presented in Tables 6 and 7 respectively. The coefficient of digestibility of the nutrients showed that dry matter digestibility was similar at T_1, T_2, T_3, and T_5 ($P>0.05$). T_2 was significantly increased ($P<0.05$) compared to T_4. Digestibility of fat was similar ($P>0.05$) at T_1, T_2, T_3, and T_4. There was no significant ($P>0.05$) difference in the crude protein digestibility of T_1, T_2 and T_5. T_4 was significantly decreased compared to T_1, T_2 and T_5. There was no treatment effect on the crude fibre and NFE digestibility. The percentage nutrient digestibility showed that there was no significant difference in the fat and ash fraction. The dry matter percentage nutrient digestibility revealed that T_1, T_2, T_3, and T_5 were significantly similar ($P>0.05$). T_2 was only significantly increased ($P<0.05$) compared to T_4. Percentage crude fibre digestibility showed that 0%, 2.5% and 5.0% cassava leaf meal inclusion level were statistically similar ($P>0.05$). Percentage fibre digestibility at T_2 and T_3 were significantly increased compared to T_4 and T_5. Percentage crude protein digestibility was significantly decreased at T_3 (5.0%), T_4 (7.5%) and T_5 (10%) cassava leaf meal inclusion compared to T_1 (0%) and T_2 (2.5%). The percentage carbohydrate digestibility was significantly increased ($P<0.05$) at T_4 (7.5%) and T_5 (10%) cassava leaf meal inclusion compared to T_1 (0%), T_2 (2.5%) and T_3 (5.0%).

Table 6: Coefficient of digestibility

Parameters	T_1	T_2	T_3	T_4	T_5	SEM
Dry matter	93.30^{ab}	95.02^{a}	93.22^{ab}	90.48^{b}	92.12^{ab}	1.2
Fat	95.87^{a}	91.98^{ab}	97.48^{a}	81.51^{c}	88.90^{b}	2.2
Ash	96.78	97.76	96.64	95.13	95.89	0.6
Crude Fibre	97.39	98.51	97.85	95.91	96.52	0.8
Crude Protein	94.08^{ab}	94.80^{a}	92.38^{bc}	90.63^{c}	93.09^{ab}	0.6
NFE	84.89	89.03	82.88	83.59	85.84	2.21

Abc means within the same row with different superscripts are significantly different ($p<0.05$)

Table 7: Percentage Digestibility

Parameters	T_1	T_2	T_3	T_4	T_5	SEM
Dry matter	87.11^{ab}	90.44^{a}	86.35^{ab}	84.45^{ab}	86.08^{ab}	1.6
Fat	1.17	1.0	1.92	1.10	1.47	0.35
Ash	15.15	15.06	17.36	17.29	17.83	1.02
Crude Fibre	26.45^{ab}	28.18^{a}	30.22^{a}	23.19^{b}	22.90^{b}	1.5
Crude protein	27.05^{a}	29.65^{a}	22.26^{b}	20.47^{b}	20.71^{b}	1.52
NFE	17.48^{b}	16.63^{b}	14.69^{ab}	22.62^{a}	23.39^{a}	1.6

Ab means within the same row with different superscripts are significantly different (P<0.05)

DISCUSSION:

The Proximate and phytochemical composition of cassava leaf meal showed that cassava leaves contained high level of protein and fiber. The protein content was higher than the values 11.81 – 22.75 and 25.10 reported by Jacob *et al.* (2019) and Iheukwumere *et al*. (2008) respectively. Protein is necessary for body growth and replenishment of body tissue. Therefore, the presence of protein in cassava leaf meal is expected to improve the growth performance of the birds when incorporated into the feed. The fiber level from this research was higher than the value 10.84, 11.40 and 10.60 reported by Jacob *et al.* (2019), Iheukwumere *et al.* (2008) and Abu *et al.* (2015) respectively. The Lipid content and the Ash content are close to the values 12.70% and 9.10% respectively, reported by Iheukwumere *et al.* (2008) and also close to the values 11.77% Lipid and 8.47% Ash reported by Abu *et al.* (2015). The carbohydrate content was lower than the values 46.10% and 73.00 reported by Iheukwumere *et al* (2008) and Abu *et al.* (2015) respectively.

Data on the performance characteristics of finisher broiler chickens fed varying levels of cassava leaf meal showed that there were significant treatment effect on the average body weight gain, average daily weight gain, feed conversion ratio and efficiency of feed utilization. T_1 (0%) and T_2 (2.5%) inclusion levels were significantly better than T_3 (5.0%), T_4 (7.5%) and T_5 (10.0%) for average body weight gain and average daily weight gain. Performance of broilers declined as the inclusion levels of cassava leaf meal increased from 5% to 10%. In other words, there was depression in weight gain with increasing levels of cassava leaf meal from 5% upwards to 10%. 2.5% cassava leaf meal inclusion was similar or equal in performance to the soya bean control treatment group, T_1 (0%). 2.5% inclusion level was the optimum performance level of cassava leaf meal in broiler finisher diet in this study contrary to 5% inclusion level of cassava leaf meal reported by Iheukwumere *et al*. (2008) for broiler finisher chickens. Feed intake was similar across treatments implying that there was no depression in feed intake as a result of cassava leaf meal consumption at these levels supporting the report of D' Mello *et al*. (1987) that 10% inclusion levels of leucocephala leaf meal depressed body weight gain of chickens without any effect on consumption of dry matter. Feed conversion ratio revealed that T_1 (0%), T_2 (2.5%) and T_3 (5.0%) were similar in performance but efficiency of feed utilization clearly demonstrated that 0% and 2.5% inclusion levels gave the optimum performance inclusion levels. From 5% inclusion levels the efficiency of feed utilization dropped significantly. This implies that digestion and utilization of nutrients were compromised or very inefficient as the dietary cassava leaf meal increased. This is in line with the observation of Iheukwumere *et al.* (2008) that the utilization of dry matter, crude protein, ether extract and nitrogen free extract decreased with increasing levels of cassava leaf meal. Suffice it to say that, several researchers have reported depressed performance when leaf meal is used in the diet of broilers. 71% depression in growth rate of chicks were observed in a diet containing 20% Robina pseudo acacia leaf meal (Cheeke *et al*., 1983). However, the report of this study is contrary to the findings of Abu *et al*. (2015) that 20% inclusion levels of cassava leaf meal and 20% cassava peelings could serve as a replacement for soya bean meal and maize in broiler starter and finisher diet without any deleterious effect on growth and carcass yield of broilers. The values of the feed conversion ratio were higher than the values 3.53-4.78 reported by Iheukwumere *et al.* (2008) for broilers fed cassava leaf meal and far above the reference values 1.7 to 2 for broilers (Ghosh, 2015). This implies that the general performance of the broilers were very poor in terms of weight gain. When the feed conversion ratio is higher in value than the reference range (1.7 – 2.0), it is a sign of poor performance in terms of weight gain or meat yield relative to feed intake.

Cost of feed was highest in T_1 and gradually decreasing as the dietary inclusion level of cassava leaf meal increased with T_5 (10%) being lowest. T_1 (0%) had only soya bean inclusion and so the cost of feed was highest due to high cost of soya bean meal while the cost of T5 (10%) was lowest due to 10% substitution of soya bean meal with cassava leaf meal which was virtually obtained at little or no cost. Cost per kg weight gain was very high at T_3 (5%), T_4 (7.5%) and T_5 (10%) due to poor feed conversion ratio which means that, at these levels of inclusion more feed was consumed to produce one kg weight of meat. T_2 (2.5%) gave the best cost per kg weight gain due to better feed conversion ratio. Cost of feed consumed (cost of production) was lowest at T_2 (2.5%) due to reduced cost per kg weight gain and heavier meat yield (that is, heavier average weight gain). Revenue and gross margin was highest and best at T_2 (2.5%) because of heavier meat yield and reduced cost per kg weight gain leading to higher revenue and profit earnings. T_4 (7.5%) and T_5 (10%) revealed negative gross margin due to poor meat yield which implies that the producer was feeding (or producing) the birds at a loss. T_2 (2.5%) showed better profit margin than the control T_1 (0%). It could be concluded from economics of production that the use of cassava leaf meal as a replacement for soya bean meal in the diet of broiler finishers at 2.5% inclusion levels resulted in heavier body weight gain and better feed conversion ratio leading to lower cost per kg weight gain, higher revenue and gross margin (profit) earning. Therefore, it is economical and cost effective to use cassava leaf meal at a level not exceeding 2.5% as a protein source to improve performance of broiler finisher chickens and have higher returns on investment.

Carcass and organ weight characteristics of finisher broilers fed varying levels of cassava leaves meal revealed no treatment effect on the live weight and dressed weight of the birds for carcass indices evaluation which implies that the cassava leaves meal had no deleterious effect on the carcass value. The cassava leaves meal groups were comparable to the control as it affects the weights of the thigh, the wings, the breast, the drumstick, the shank and the back. This implies that there was no negative effect of the cassava leaf meal on the carcass cuts. The organ weights revealed that the hearts, the gizzard and the length of the intestines were not negatively affected. The cassava leaves meal group were comparable to the control. The liver of birds fed control diet was similar to the cassava leaf meal group except for 7.5% inclusion level that was increased significantly. It could be concluded that the cassava leaf meal had no deleterious effect on the carcass and organ characteristics of the broiler finisher chickens.

Nutrient retention of broiler finisher chickens fed varying levels of cassava leaf meal showed that dry matter intake was similar compared to the control supporting the observation in this study that there was no depression in feed intake when cassava leaf meal is incorporated in the ration of broiler finishers at up to 10% inclusion levels. This implies that anti-nutrients in the cassava leaf meal had no effect on consumption at these varying levels of 0-10% inclusion levels. Ether extract (fat) intake decreased from 7.5% to 10% inclusion levels implying that energy potential levels decreased and mobilization of fat for tissues synthesis was reduced thereby affecting gain in weight. It was an indication of low intake of fat nutrients. This was evidenced by the sharp drop in weight gain from 7.5% -10% inclusion levels of cassava leaf meal. Crude protein digestibility indicated that protein intake decreased from 5.0% through 10% inclusion levels which affected body growth rate at these levels since protein is responsible for body building, development and growth. Low intake of protein nutrients will negatively affect growth rate. Metabolism of amino acids was impaired at these levels. This could be attributed to the limiting amino acids in cassava leaf meal, methionine and tryptophan. It has been reported that cassava leaves are low in sulfur amino acids (Phuc *et al*., 2000). The Ash, crude fibre and crude carbohydrate (Nitrogen Free Extract) intake were similar across treatments. Digestibility rating in this study ranged between 81.51 and 98.51%. Digestibility percent rating has been reported by Alimuddin (2000) to be good when above 70%, moderate when between 40 and 60% and very low when below 40%. In this study, the digestibility of dry matter by the broiler finishers was good across treatments. Crude protein digestibility was generally good across treatments too based on the rating pattern, however, the little differences in nutrient digestibility were reflected on the performance of the birds with 0% and 2.5% inclusion levels having higher treatment effect on feed conversion ratio and consequently higher revenue and profit margin.

CONCLUSION

The result of the trial showed that cassava leaf meal contains nutrients which can be of value in animal nutrition especially proteins, fat and carbohydrate.

It also revealed that cassava leaf meal could serve as a protein source for broiler finisher chickens. It is economical and cost effective to use cassava leaf meal at a level not exceeding 2.5% as a protein source to improve performance of broiler finisher chickens and have higher returns on investment.

The study also revealed that cassava leaf meal did not compare favorably with soya bean meal in producing heavier meat and hence reduction in revenue and profit.

The trial also revealed that cassava leaf meal causes depression in performance of broilers at a higher inclusion levels of 7.5% and above.

The trial also revealed that cassava leaf meal had no deleterious effect on the carcass and organ weights of broiler finisher chickens.

It was therefore concluded that cassava leaf meal could serve as a protein source to replace soya bean meal in the diet of broiler finishers at a level not exceeding 2.5% to reduce cost of production and earn higher revenue.

RECOMMENDATION

It was therefore, recommended that cassava leaf meal could serve as a protein source in broiler finisher ration at not more than 2.5% inclusion level.

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