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Growth performance, carcass traits and cost benefits of feeding weaner rabbits with leafy multinutrient miniblock

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Target Audience*: Farmers, Nutritionists, Researchers, Livestock economist*

Abstract

Study on the formulation and production of leafy multi-nutrient blocks ((control, MNB1, MNB 2 and MNB 3) for feeding rabbits using Pawpaw and Tridax leaves at ratios 0:0, 1:1, 3:2, 7:3 was conducted. Ninety-six, 7-week-old weaner rabbits with average body weight of 406.67± 0.01 g were divided into four treatments. Treatments were replicated twelve times. Experimental treatments were arranged in a Complete Randomized Design (CRD) and the feeding trial lasted 10 weeks. Result revealed that final live weight, weight gains, feed intake and feed conversion ratio were significantly influenced by the dietary treatments.The lowest feed conversion ratio (4.79) was observed in the group fed MNB 3. Significantly (P<0.05) highest carcass dress weight percentage was observed among the rabbits fed MNB 3. Diets significantly influenced legs, loin, thigh and gastrointestinal weights with MNB3 rabbits having the highest values except the GIT. The cost benefits revealed that ₦661.02 were incurred on MNB3 and ₦1344 on control. Furthermore ₦149.21 and ₦309.55 were the costs saved on MNB1 and MNB2 respectively as against control (₦682.98) which is higher than MNB1 and MNB2 mini block. Feeding MNB formulation favoured rabbits fed MNB 3. It was evident in this study that inclusion of pawpaw and tridax leaves at ratio 7:3 in MNB diets encouraged better performance and carcass yield in rabbits.

Keywords*: Pawpaw(Carica papaya); Tridax (Tridax procumbence); Multinutient; Miniblock; Rabbits*

Description of Problem

The shortage of animal protein is a common problem facing the devolping countries of which Nigeria is a part. Today, many Nigerians, particularly the children are dying in thousands because of malnutrition. (5) reported that protein and other essential nutrients are lacking in the diets of even small proportion of Nigerians adults, who can not find enough food to eat. Protein and essential nutrients supply may, however, be improved by short generation interval animals like pigs, rabbits, and poultry production (18). (14) stated that Rabbit farming is very suitable in rural area with a small business scale to meet the needs of the animal protein in addition to increase community income. However, poultry and pigs production require feed resources which are in serious competition with man and with this it makes rabbit production to be preferable. Low-fat content and low sodium content of rabbit meat makes it a good source of animal protein for coronary heart disease patients and people on low sodium diet. Other qualities of rabbit meat are rich vitamins and iron contents, juiciness, tenderness, and good flavour (22). Rabbits are reared as backyard, commercial and research animals for meat and for scientific purpose . (15) reported that the ability of rabbits to thrive on diet low in grains and high roughages due to their simple non-compartmentalized stomach and enlarge caecum and colon – line ruminants' and its ability to thrive on forages and agricultural by-products makes the production cheap, which could play an important role in increasing food protein supplies in tropical countries. Since the early eighties, the manufacture and utilization of multi-nutrient blocks as supplements for ruminant animals has increased considerably in developing countries. However, the manufacture of these blocks for rabbits was first suggested by (20) and (7). These blocks were designed to replace the pellets or mash that are commonly used in developed countries, but which are too costly to be manufactured in most developing countries (21). They usually do not contain urea and can be formulated to include the forage component of the diet, thus making complete feed. Feed blocks are used to supply supplementary nutrients to ruminants in situations where conventional supplements such as concentrates are not available or not economical or cannot be used for other reasons. This is also applicable to rabbits. In other words, feed blocks came into play as supplements to roughage to augment productivity. The introduction of these feed-blocks will help in eliminating the peculiar problems associated with rabbit production, that is, the respiratory disorder and wastage of the feed. Nevertheless, it will proffer solution to the imbalance nutrient supply, particularly the nitrogen aspects and looking at the meat output of rabbit, it is interesting to know that rabbit has great potential in solving the prevailing problem of protein malnutrition and under-nutrition especially in the tropical and subtropical regions of the world (13). Also the multinutrient block is an excellent way of providing readily degradable protein and readily fermentable energy to rabbits and ruminant animals and can increase digestibility and feed intake of fibrous feeds by up to 20% and 25 - 30%, respectively. The use of pawpaw and tridax leaves is underscored by the fact that they contain a broad spectrum of phytochemicals such as enzyme (pawpaw papain), alkaloids, and phenolics (2) and the anti-bacterial, anti-viral, anti-inflammatory, wound healing, free radical scavenging, and anti-fungal activities of pawpaw had been reported (2). Pawpaw has been identified as a natural antioxidant (7), and pawpaw leaves have been tested and found to contain essential ingredients capable of enhancing feed intake, feed utilization and suppression of pathogens' growth (2 and 7). Tridax contains up to 26% crude protein, 39% soluble cabohydrates, 17% crude fibre and essential minerals such as calcium, phosphorus, magnesium selenium, iron, sulphur, sodium and chlorine. Amino acids, flavanol, synergic acid, tannin, steroids, polysaccharides, alkaloids, pectin, hemicelluloses and volatile oils (7). Therefore, pawpaw and tridax leaf meals inclusion in rabbits' multinitrient blocks could be of health benefits against oxidative stress and several diseases. The present study was therefore undertaken to investigate ways of improving rabbit production and consumption in Nigeria by replacing rabbit basal diet with multinutrient mini block on the growth performance, carcass quality and cost benefit of producing multinutrient mini block for weaner rabbits.

Materials and Methods

The research was carried out in the rabbit unit of the Directorate of University Farms, Federal University of Agriculture Abeokuta. The area is situated on latitude7^{o}13' 23.8" North, Longitude3^{o} 26' 14"East and the altitude of 148m above sea level in Alabata of Odeda Local Government area in Ogun State, Nigeria. The area lies in the tropical climate with an average annual rainfall of 1100mm and a mean ambient temperature of about 34^{o}C. The relative humidity is 60% in January 2019 and 94% in July-September 2019, with yearly average of 82%.

Experimental design, housing, and management

The study was conducted with Ninety-six 7-week old mixed breed and sexes of rabbit. The average initial live weight was 406.67g.

They were randomly divided into fourty-eight groups of two rabbits each. Twelve of such groups were assigned to each of the dietary treatments respectively. The experimental design was Completely Randomized Design (CRD). Two rabbits were housed in a compartment. The hutch had the following dimensions: length – 105cm, width 85cm and height 60cm. The hutches were made with wire net raised on metallic legs about 60cm above the ground. The rabbits in hutches were placed inside a walled house built with concrete block and asbestos roofing material. The metallic hutches were covered to some extent with mesh that would permit inspection, ventilation and dropping of rabbit faeces onto the cemented floor. Each hutch was provided with feeding and watering troughs, which were made from clay. At the beginning of the experiment, all animals were treated with ivomec® injection against hemiparasites, internal and external parasites. The animals were weighed at the beginning of the experiment as the initial weight and subsequently weekly in the morning before feeding. Feed and clean water were offered *ad libitum*

Dietary treatments and preparation

The multinutrient block rations (MNB1-3) were formulated in such a way that all ingredients were fixed except pawpaw and tridax leaves that were mixed at ratios 0:0, 1:1, 3:2 and 7:3 (26). Ten percent cement was used as a binder which according to (11) was within tolerable level for rabbits and ruminants. The use of cement combined with molasses as binders ensures the slow release of otherwise active ingredient and to ameliorate toxicity. A mash diet was used as control and at the same time having approximately energy/protein ratio. The compositions of the experimental rations are shown in Table 1.

Molasses was sourced from Dangote Sugar Industry,Lagos Apapa while cement and other feed ingredients were all sourced locally. Pawpaw and tridax leaves were harvested and air dried for a period of three weeks and milled separately before mixing at aforemention ratios. All the components were weighed out into a mixing bowl of mixer, vitamins premix and salt lumps were avoided.

Mixing of feed ingredients

Mixing of feed ingredients was done in small quantities. Approximately 25kg of feed were mixed per batch to get homogenous mixture. The order of mixing miniblock ingredients recommended by (3) as followed. The binder (cement) was dissolved in a bucket and after being mixed thoroughly it was poured into the drum which already contained the dissolved molasses. The two solution was stirred and mixed properly to obtain a homogeneous mixture. Other ingredients were added as follows, tridax leave, pawpaw leave, maize, wheat offal, soya beans meal, bone meal, oyster shell, fish meal, blood meal, methionine, vitamin premix and salt. Each ingredient was added only after a homogenous mixture of other ingredients was obtained (3).

Moulding and drying of mini blocks

The resulting homogenous mixture was placed on a polythene nylon spread on the floor. The material block was pressed manually into miniblock mould to get 15g miniblocks size. Mini blocks formed were sundried in a partially shaded area for a minimum of 4 days.

Parameters measured

Growth Performance

Feed consumption of each replicate group was calculated on weekly basis as the difference between feed offered and feed left over from *ad libitum* feeding. Live weight of the rabbits was also measured weekly. The efficiency of feed utilization was calculated by dividing the feed consumed by the weight gain. The protein efficiency ratio was calculated by dividing the weight gained by the protein intake within a given time for each replicate group. Weight gains were calculated by subtracting initial weight from the final weight. Total feed intake for all replicates in each treatment were pooled together to obtain total feed intake for each treatment replicate. Mortality was measured as record of the total number of dead rabbits and were expressed as percentage.

Table 1: Composition of the experimental diets

Composition in g/Kg				
Component	Control diet	MNB1	MNB2	MNB3
Maize	492.00	100.00	100.00	100.00
Soyabean meal	245.00	137.00	137.00	137.00
Pawpaw leaves	0.00	250.00	300.00	350.00
Tridax leaves	0.00	250.00	200.00	150.00
Cement	0.00	10.00	10.00	10.00
Molasses	50.00	50.00	50.00	50.00
Fish meal (72%)	14.00	14.00	14.00	14.00
Blood meal	14.00	14.00	14.00	14.00
Wheat offal	150.00	150.00	150.00	150.00
Oyster shell	16.00	16.00	16.00	16.00
Bone meal	10.00	10.00	10.00	10.00
Methionine	4.00	4.00	4.00	4.00
Vit/Mineralpremix	2.50	2.50	2.50	2.50
Salt	2.50	2.50	2.50	2.50
Total	1000.00	1000.00	1000.00	1000.00

*Vitamins/ Mineral premix (**Roche Nutripoul 5$^{(R)}$**): Based on 2.5kg per ton.
Vit.A:10 000 000 IU, Vit.D_3: 2 500 000 IU,Vit.E 20 000 mg, Vit.K_3: 2 000mg, Vit.B_1:3 000mg, Vit.B_2:7 00 Biotin:50mg, Manganese:80 000mg,Iron: 40 000mg, Zinc: 60 000mg, Copper :8 000mg , Cobalt: 250mg,Iodine 1000mg, Selenium(1%): 150mg,Choline:200000mg and Antioxidant: 100 000mg

At the expiration of the 10 weeks feeding trial, one rabbit per replicate was selected randomly and sacrificed by stunning, bleeding and evisceration. Prior to this the rabbits were fasted for 24 hours to empty their gastrointestinal tract. Live weight of the rabbits was taken just before carcass evaluation. After evisceration, the dressed weight was recorded. The head, leg and gastrointestinal tract. were removed and weighed. The heart, liver, shoulder, rack, loin, and thigh were carefully excised and weighed fresh. All weights were done using a sensitive electronic scale (Acculab^R Model 2001 Electronic Digital Scale) and weights were expressed as a percentage of live weight. Each carcass was cut into major retail cut parts (Shoulder, Rack, Loin, Thigh, Leg and Head)

Chemical and cost evaluation analyses

The Pawpaw(*Carica papaya*) leaves, Tridax (*Tridax procumbence*) leaves and molded mini blocks produced were chemically analyzed for Dry matter (DM), Crude protein (CP), Crude fibre CF, Ether Extract EE, Ash and Nitrogen free Extract (NFE) using (4) method.

Cost evaluation of the diets in relation to performance of the animals were done to determine the cost benefit of feed required to produce 1kg of bodyweight. It was calculated using method suggested by (6) and (27) as follows:

$Y_1 = (p_1 X Q_1)/G$

Where Y_1 is the feed cost per kilogramme live weight gain in the treatment

P_1 is the price per kg feed used in

the treatment

Q is the amount of feed consumed in the treatment

G is the weight gain in the treatment

Cost saving kilogramme weight gain is the cost difference between control and other treatments

Statistical analysis

The data obtained in these studies were subjected to One Way Analysis of Variance (ANOVA) Duncan- Multiple Range Test in the software package was used to separate significant differences among the means.

Model used is $Y_{ij} = U + T_i + E_{ij}$

Where Y_{ij} = dependent variable (Performance, carcass quality and cost benefit)

U = Population means

T_i = effect of the diet

Results

Proximate constituents of the leafy multinutrient miniblocks of pawpaw and tridax leaves were shown in Table 2. The analyses were done on dry matter (DM) basis. The crude protein(CP) increased with increased levels of pawpaw leaf and decreased levels of tridax leaf in the diets while the ether extract and nitrogen free extract (NFE) decreased with the increased levels of pawpaw and decreased levels of Tridax in the diets (Table 1). Except the crude fibre and the ash contents that decreased as the levels of pawpaw leaf were gradually substituted by tridax. However the DM and GE contents of the diets followed no defined trend.

Performance traits

Performance traits measured comprised of body weight, weight gain, feed intake, feed efficiency and mortality. The mean values of the performance characteristics of rabbits fed the experimental diets over the periods of 10 weeks were shown in Table 3. All these parameters were significantly influenced by the dietary treatment except initial weight and mortality. Final body weight and weight gain over the 10 weeks period were significantly different ($P< 0.05$) across the dietary treatment groups (Table 3). The daily weight gain per rabbit significantly ($P< 0.05$) increased across the treatment groups. Both the final body weight and the daily weight gain of rabbits fed dietary treatment MNB3 were highest ($P< 0.05$) while the lowest value was observed in treatment group MNB1. The mean final body weight ranged from 1318.37 to 1541.70g per rabbit while the mean weight gains ranged from 911.70 to 1135.03g per rabbit while the daily weight gain was in the range of 13.02 to 16.21g/rabbit/day. The significant ($P<0.05$) influence of the dietary treatment was noticed in the values of the total feed intake per rabbit. Feed intake was highest ($P< 0.05$) in the rabbit fed the MNB1 diets while the lowest intake was observed in rabbits on treatment MNB 3. The total feed intake in the experiment ranged between 5436.79 and 6354.55g per rabbit.

Lowest ($P< 0.05$) feed conversion ratio was noticed in rabbits fed treatment MNB 3 while the poorest was noticed in the group fed MNB1 and the values of feed conversion ratio was in the range of 4.79 to 6.97. Mortality was low throughout the period of study (10 weeks) and the percentage mortality was statistically the same ($P> 0.05$) across the treatment groups. Mortality values ranged between 0 and 1%.

Table 2: Chemical composition of experimental diets

	Experimental Diets *gkg^{-1}DM Composition			
Parameters	CONTROL	MNB1	MNB2	MNB3
Dry Matter	955.60	920.00	900.00	890.00
Crude Protein	214.90	224.40	229.70	237.30
Crude Fibre	99.50	114.00	109.60	105.50
Ether Extract	34.20	29.50	28.20	26.80
NFE	563.20	439.90	420.50	414.90
Ash	53.80	115.10	110.30	105.50
Gross energy(kcal/kg)	4263.44	3848.85	3912.90	3977.42

MNB1 = Multi nutrient blocks 1; MNB2 =Multinutrient blocks 2; MNB3 = Multinutrient blocks 3

Table 3: Growth performance of rabbits fed multinutrient mini blocks

	EXPERIMENTAL DIETS				
Measurements (g)	CONTROL	MNB1	MNB2	MNB3	SEM
Initial BWT	406.69	406.66	406.69	406.67	0.01
Final BWT	1404.88^{ab}	1318.37^{c}	1356.67^{b}	1541.70^{a}	18.10
Weight gain /rabbit	998.21^{ab}	911.70^{c}	950.00^{b}	1135.03^{a}	25.65
Daily weight gain/rabbit	14.26^{ab}	13.02^{c}	13.57^{b}	16.21^{a}	2.28
Total feed intake/rabbit	5590.00^{b}	6354.55^{a}	5557.50^{b}	5436.79^{b}	49.77
Daily feed intake/rabbit	79.86^{b}	90.78^{a}	79.39^{b}	77.67^{b}	4.73
Feed conversion ratio	5.60^{b}	6.97^{a}	5.85^{b}	4.79^{c}	1.01
Mortality	0.00	1.00	1.00	0.00	0.00

^{abc} All values within a row having no superscript or with the same superscript are not significantly different(P>0.05)

BWT = Body Weight; MNB1 = Multi nutrient blocks 1; MNB2 =Multinutrient blocks 2; MNB3 = Multinutrient blocks 3; SEM = Standard error of mean; All costing were done in Naira.

Carcass characteristics

Results of carcass analysis as percentage of live weight are shown in Table 4 such that the dress weight ranged from 64.09% for MNB1 to 69.36% for MNB3, and a significant difference was noticed among the treatment groups(P< 0.05). Dress weights of the legs, loin, and thigh were significantly (P<0.05) affected by MNB diets. The value ranges were as follows: legs (2.27-2.98%), loin (10.01-13.31%) and thigh (17.16-24.99%) respectively. Statistica differences (P<0.05) were also noticed in the percentage weight of gastro- intestinal tract (GIT). There was no significant (P>0.05) difference among the dietary treatments' groups in terms of liver, lung, kidney, and heart weights. Values ranged from 17.30-26.53% for the GIT, 2.49-2.68% for the liver, 0.57-0.62% for the lungs 0.52-0.60% for the kidneys and 0.25-0.27% for the heart. No significant difference (P>0.05) was also noticed in all the gastrointestinal length parameters measured. The length of the oesophagus, stomach, small intestine, large intestine, caecum, and rectum were in the ranges of 0.72-0.81cm, 0.71-0.83cm, 19.33-22.32cm, 2.99-3.19cm, 8.04-8.68cm and 2.35-2.94cm respectively which were statistically similar across treatment groups.

Cost benefit

The cost benefit of feeding multi-nutrient mini blocks to rabbits was presented in Table 5. The cost of feed per kg(₦) of the dietary treatment ranged from ₦138.00 (MNB 3) to ₦240.00 (control).

Total feed per kilogramme weight gain ranged from 4.79 to 6.9 (Table 2 and 5)while cost of feed consumed per kg weight gain ranged from ₦661.02 to ₦1344.00. Marginal cost/kg (cost saving) of feed ranged from ₦149.21 to ₦682.98. The diets cost were significantly different ($p<0.05$) (both control and other treatments) in terms of the total cost of feed per kg weight gain. It was observed that the inclusion of pawpaw tridax leaves resulted in a decrease cost of feed (Table 1 and 5).

Table 4: Carcass evaluation of rabbit fed multinutrient mini blocks

	TREATMENTS				
	CONTROL	MNB1	MNB2	MNB3	SEM
Liveweight (kg)	1.42	1.40	1.39	1.42	0.17
Dress weight (%)	68.98^{a}	64.09^{b}	64.80^{b}	69.36^{a}	1.09
Cut-up parts (%)					
Shoulder	9.64	8.97	8.98	10.51	1.03
Rack	9.94	11.85	10.81	10.86	2.50
Legs	2.91^{a}	2.27^{b}	2.82^{a}	2.98^{a}	1.80
Loin	11.75^{ab}	10.01^{b}	11.06^{b}	13.31^{a}	3.60
Thigh	20.59^{b}	17.16^{b}	18.33^{b}	24.99^{a}	7.50
Head	10.00	10.18	9.90	8.90	2.60
Organ weight (%)					
GIT	17.30^{b}	26.53^{a}	23.53^{a}	21.87^{ab}	9.00
Liver	2.49	2.68	2.65	2.57	0.07
Lungs	0.59	0.57	0.61	0.62	0.13
Kidneys	0.52	0.57	0.58	0.60	0.09
Heart	0.25	0.26	0.27	0.25	0.01
Gastro-intestinal length (cm)					
Oesophagus	0.72	0.81	0.76	0.79	0.02
Stomach	0.79	0.83	0.71	0.79	0.02
Small intestine	19.33	21.00	20.88	22.23	1.10
Large intestine	2.99	3.19	3.06	3.04	0.10
Caecum	8.48	8.68	8.53	8.04	0.15
Rectum	2.94	2.42	2.35	2.74	0.10

[abc]All values within a row having no superscript or with the same superscript are not significantly different(P>0.05)

MNB1 = Multi nutrient blocks 1; MNB2 =Multinutrient blocks 2; MNB3 = Multinutrient blocks 3; SEM = Standard error of mean; All costing were done in Naira.

Table 5: Cost benefit of feeding multinutrient mini block to Rabbit

	TREATMENTS				
Parameters	Control	MNB1	MNB2	MNB3	SEM
Cost/kg of concentrate feed₦	240.00a	139.25^{b}	138.30^{b}	138.00^{b}	9.98
Feed/kg weight gain	5.60^{b}	6.97^{c}	5.85^{b}	4.79^{a}	1.01
Feed cost per BWgain ₦	1344.00^{a}	970.57^{b}	810.23^{b}	661.02^{c}	21.27
Cost saving kg per feed ₦	682.98^{a}	309.55^{b}	149.21^{c}	0.00^{d}	14.03

[abcd]All values within a row having no superscript or with the same superscript are not significantly different(P>0.05)

MNB1 = Multi nutrient blocks 1; MNB2 =Multinutrient blocks 2; MNB3 = Multinutrient blocks 3; SEM = Standard error of mean; All costing were done in Naira.

Discussion

The improve weight gain obtained from rabbits as a result of MNB3 feeding are consistent with the experiment conducted by (24) who study the inclusion of urea molasses multinutrient cake which contains (soyabeans meal, mustard oil cake added with the broken maize and wheat bran) in diets of rabbit does where the live weight of pregnant does was better ($P<0.05$) than those fed on basal diet, and the values of the daily weight gain was higher than those reported by (8).

The significantly higher feed intake noticed in rabbits fed MNB1 could be linked with the level of the dietary fibre. Rabbits fed MNB1 had higher dietary fibre intake arising from higher daily feed intake; and so, a linear relationship was noticed of the correspond treatment groups. (23) and (28) stated that unlike human and rodents, rabbit is much sensitive to the dietary fibre content and obviously shows individual difference in tolerance against fibre-deficiency diet. Animals are known to eat to satisfy energy needs, hence the higher feed intake of MNB1.

The best response in terms of feed utilization which is feed conversion ratio was obtained in the rabbits fed mini block containing 7:3 pawpaw tridax mixture (MNB3). There was also a linear decreased in the feed utilization efficiency as the level of tridax decreased across the dietary treatments MNB1 to MNB3. The gradual decline in dietary fibre and feed conversion ratio values translated into a weight gain increased. This suggested that any further increase in the ratio of pawpaw to tridax in the miniblock beyond 7:3 would result in a better feed conversion and weight gain. The inclusion of tridax in this study at 25% (MNB1), 20%(MNB2) and 15% (MNB3) level decreased the fibre content of the resulting diets by 14.4%, 10.1% and 6% respectively. This has tendency to improve the performance response linearly as shown in values obtained for feed conversion ratios for MNB1, MNB2 and MNB3.

There was no significant difference ($P>0.05$) between the performance response of the control group and those of the group that were fed MNB2, although the control numerically was better. Further increase in the proportion of pawpaw leaf in the mini- nutrient block as in MNB3 resulted in a performance that was significantly better than the control. Hence as more of the pawpaw is substituted for tridax, the protein content and the gross energy of the resulting diet increases. Therefore, the sub marginal level of protein and energy could have resulted in a linear increase in the feed utilization as observed in the study.

The feed consumed per kilogram weight gain decreased proportionately with dietary fibre content MNB1 to MNB3 value. The possible explanation for this better performance noticed in MNB3 group could be due to some enzymes contained in the pawpaw leaf (2). This is reflected in the values obtained for feed conversion ratio and the proximate concentration of fibre. Papain a proteolytic enzyme present in the pawpaw leaf meal could have aided the digestion of protein, thereby releasing the free amino acids necessary for growth (17).

The trend noticed in the percentage dress weight was like the trend noticed in the weight gain and efficiency of feed conversion ratio. This indicated that the better weight gain and feed conversion noticed in the MNB3 translated to a proportionate superior dressing percentage. It also means that the rabbits fed MNB3 deposited more protein as muscle tissue than the others. The range of dressing percentage in this study was higher than the range of 55.30±0.72-67.45±0.43% reported by (9). The legs, loin, and thigh form the major portion of the weight of the hind limbs and the fact that the limb are early maturing parts of the body and contained long bones could be responsible for the significant response noticed among the treatment group. (10) stated that meat bone ratio is a good predictor of meat content in carcass.

Significantly higher GIT weight was noticed in the treatment groups MNB1 and

MNB2, which could likely be linked to the higher feed intake. Similarities in the relative weight of liver, lungs and kidney across the groups showed that the rabbits were able to tolerate the mini blocks well. The values obtained for the heart was lower than those reported by (19), This observations underscore the fact that the heart, being vital organ, attained most of its mature weight during development of the foetus, hence feeding of miniblock diets did not significantly change heart weight during the later stages of growth. No significant difference was noticed in the gastrointestinal length measurements, however, the small intestine was comparatively longer than all other parts, this could be because major digestion and absorption processes take place in this region, this further corroborate the observations of (12) for normal healthy rabbits.

The cost benefit accruing from feeding of the dietary treatments (MNB1 to MNB3) compared with control group was greatly different from each other in terms of total feed cost, daily feed cost per animals and cost of feed per kg weight. The cost per kg of feed generally decreased as the level of pawpaw leaves increased and tridax leaves decreased in the diets. This implies that the use of pawpaw and tridax leaves in rabbit feeds on a large scale may resulted in cost saving, and this agreed with the studies by (16) who reported that the need to lower feed cost to produce affordable meat and healthy animal products for man which cannot be over emphasized in the face of the dwindling standard of living. However, in terms of cost benefit per kilogramme weight gain, inclusion of pawpaw and tridax leaf was economically better even though the values declined with the level of the pawpaw-tridax ratios (1:1, 3:2 and 7:3) leaves in the diets. This was partly due to declined utilization. This agreed with the findings of (1) who reported that inclusion of leafy concentrate in the diet of rabbits may not have been attained and perphaps incremental level beyond 30% inclusion may still yield higher cost benefit ratio beyond the value recorded in their trial which implies that a diet may be the cheapest, but its utilization by the animals may be the poorest.

Conclusion and Applications

The following conclusion were drawn from the result obtained in this study:

1. Performance response of rabbits on the various treatments indicated that the rabbits fed diets MNB3 had a mean body weight which was significantly higher than the mean weight of rabbits fed diets MNB2 and MNB1.
2. Significantly superior dressing percentages were obtained in MNB3 and the control groups. No significant difference was noticed in the gastrointestinal length measurements.
3. The cost per kg of feed generally decreased as the levels of pawpaw and tridax leaves increased in the diets. In terms of cost benefit per kilogramme weight gain, inclusion of pawpaw and tridax leaf was economically better.
4. Inclusion of pawpaw and tridax leaves at ratio 7:3 in multinutrient miniblock diet encouraged better performance and carcass yield and it is therefore recommended.

References

1. Adeniji, A.A., Gana, E.S., Chibuogwu, I.C. and Onya, C. (2011). The feeding value of *moringa oleifera* leaves for growing rabbits. Proceedings of the 36th Annual conference of the Nigeria Society for Animal Production, March 13-16, (2011). University of Abuja, Nigeria, pp: 610-613.
2. Adu, O.A., Akingboge, K.A., and Akinfe, D. (2009). Potency of pawpaw (carica papaya) Latex as an anthelmintic in poultry production. *Botany Research International*, 2, 139-142.
3. Aye, P.A. and Adegun, M.K. (2010). Digestibility and growth in West African Dwarf sheep fed gliricidia-based multinutrient supplement. *Agriculture and*

Biology Journal of North America. 1(6) 1133-1139 http://www.scihub.org/ABJNA.
4. A.O.A.C. (2012). The official Analytical chemist's 12*th* Edition. Washington. D.C.
5. Atimo, A.J. and Akinyele, E.O. (2017). Waste effect of varying levels of brewers' drier on the performance and carcass quality of weaners rabbits. *World Rabbit congress* 11: (92-108)
6. Bellaver, C., Fialho, E.T.and Protas, J.F.S. (1985). Radicula in the feeding of growing and finishing pigs. Agribusiness Bras., v 20 p 967-978
7. Cheeke, P.R and Raharjo, J.C (1988). Evaluation of tropical forages and agricultural by- product as food for rabbits. *Colombia, CIPAV,* Pp.33-42.
8. Elamin, K.M., and Yousif, I.A. (2011). Evaluation of litter traits in Sudanese Rabbits. *Livestock Research for Rural Development* pp 25-30.
9. Idowu, O.M.O., Idowu, O.A., Jegede A.V., Alabi, E.E, Adenuga, A.O. and Bamigbose, A.M. (2006). Performance and carcass characteristics of weaner Rabbits fed Diets containing cassava root peel and cassava sievate. *Tropical Journal of Animal science.* 9(1): 81-87.
10. Larzul, C. and Gondret, F. (2005). Genetic aspects of meat quality in rabbits. *INRA Productions Animales* 18: 119-129.
11. Manta, I.H., Aduba, J.J., Dada J.T. and Onyemize C.U. (2013). Development of urea molasses multinutrient block (UMMB) feed for Ruminant Animals as a supplementary feed to cushion the effect of Draught in Northern Nigeria. *International Journal of Environmental sciences* vol. 2(3) Pp 106-109
12. Mudunuru, U., Lukefahr, S.D., Nelso, S.D. and Flores, D.O. (2008). Performance of Rabbits fed *Lablab purpureus* forage with molasses mini-blocks and Restricted commercial pellets in 9th *world Rabbits congress, June 10-13, Verona, Italy.*
13. Mutubi, B.W., Muiru, H.K. and Tobeck, J.K. (2017). Nutritive evaluation of some Acacia tree leaves from Kenya. *Animal Feed science and Technology*. 87: 79-95
14. Nuriyasa, I.M., Puspani, E. and Yupardhi, W.S. (2018). Performance and carcass of local rabbit (*Lepus nigricollis*) fed concentrate on different levels based on carrot leaf waste. (*Daucus carota L.*) *International Journal of Life Science,* 2: 13-19.
15. Odunsi, P.A., Kehinde, P.A., Sahhu, I.S., Oladele, S.B. and Olatunji, O. (2018). Nutrient intake and digestibility of West African dwarf goats fed levels of *faidherbiaalbida* pod meal *Iranian Journal of Applied Animal Science* 1(1) 170-179
16. Ogundipe, S.O., Abeke, F.O., Sekoni, A.A., Dafwang, I.I. and Adeyinka, I.A. (2003). Effects of duration of cooking on the utilization of Lablab purpureus beans by pullet chicks. Proceeding of the 28th Annual Conference of the Nigeria Society for Animal Production, March 16-20, Ibadan, Nigeria, pp:233-235
17. Onyimonyi, A.E. and Ernest, O. (2009). An assessment of pawpaw leaf meal as protein ingredient for finishing broiler. *International Journal of Poultry Science*, 8(10), 995-998.
18. Oyegbile, S.M. (2018). Performance of rabbits fed raw and toasted sesame (*sesame indicum*) as a source of Methionine. *Continental Journal of Agricultural Science* 5: 42-49.
19. Ozung, P.O., Bitto, I.I., Ikurior, S.A., (2011). Carcass yield, gut morphology, reproductive tract morphometry and some biochemical characteristics of serum in female rabbits fed cassava peel meal-based diets *Continental Journal of Animal Veterinary. Research*. 3: 22-32.
20. Perez, R. (1986). The use of molasses for monogastrics. In:Sugar cane as feed (Editors: Sansoucy R, Aarts G. and Preston T.R.). FAO Animal production and health paper 132, 71: 215-234.
21. Perez, R. (1990). Intensive livestock production systems based on local resources in Cuba. In: Developing World Agriculture. SpeedyA.W. (ed.), Grosvenor Press International, London. Pp 230-237.
22. Polak T., Gasperlin L., Rajar, A. and Zlender B. (2006). Influence of genotype

lines, age at slaughter and sexex on the composition of rabbit meet. *Food Technology and Biotecnology* 44:65-73

23. Rochambeau, H.de., Licois D., Gidenne, T. and Verdelhan S. (2006). Genetic variability of the resistance for three types of enteropathy in the growing rabbit. *Livestock science*. 101, 110-115
24. Ruknuzzaman, M., Miah, A.G., Sobuz, S.H. Hamid M.A., Asaduzzaman, M. and Salma, U. (2018). Effect of Dietary urea molasses multi-nutrient cake (UMMC) on productive and Reproductive performance of Rabbit. *Open Journal of Veterinary Medicine*, 8, 146-166.
25. Steel, R.G.B., Torrie, J.H. and Dicky D.A (1997). Principles and procedure of statistics. A Biometrical Approach. 3rd Edition McGraw Hill, Inc. Book co., New York, 352-358.
26. Taiwo, A.A.; Adejuyigbe,A.D.; Adebowale, E.A.; Oshotan, J.S. and David O.O. (2005). Performance and nutrient digestibility of weaned rabbits fed forages supplemented with concentrate. *Nigeria Journal of Animal Production* 32(1) 74-78
27. Tavernari F.C., Dutra Junior,W.M., Albino, L.F.T. (2009). Effects of the use of sunflower meal in the diet of broilers. *Revista Brasileira de Zootecnia Volume* 38 p 1745-1750
28. Zhang, G.W., Hong, Z.W., Shi, Y.C., Zi, C.L., Wen, X.Z. and Song J.L. (2011). A reduced incidence of digestive disorders in rabbits is associated with allelic diversity at the TLR4. *Locus Veterinary Immunology and Immunopathology*. 14: 482-486.