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# GROWTH AND ECONOMIC PERFORMANCE OF WEANED RABBITS FED CONCENTRATE DIET SUPPLEMENTED WITH DISCARDED CABBAGE (*Brassica oleracea*) AND LETTUCE (*Lactuca sativa*) FOLIAGE

**[1]Usman*, E H and [2]Shaahu D T**

[1]Animal Experimental Farm, Federal College of Veterinary and Medical Laboratory Technology Vom, Plateau State

[2]Department of Animal Production, Joseph Sarwuan Tarka University Makurdi, Benue State

*Email; usmanenemona@yahoo.com

**ABSTRACT**

This trial was conducted to study the effects of supplementing concentrate with cabbage (*Brassica oleracea* ) and lettuce ( *Lactuca sativa)* In the sixty (60) days feeding trial involving forty (40) weaned rabbits aged between 6-8 weeks with average initial weight of 750 g. The rabbits were allotted to four experimental treatments in a completely randonmised design. Treatment 1 were fed the control diet (concentrate only). Treatment 2 (concentrate + cabbage) and 3 (concentrate + lettuce) and treatment 4 (concentrate +cabbage +lettuce). Freshly collected discarded *Brassica oleracea* and *Lactuca sativa* leaves were offered to the animal *ad libitum* and concentrate given at 3% of body weight. The chemical composition of the forages were analysed. Significant difference ($P<0.05$) were observed ($P < 0.05$) in daily body weight gain (WG), forage feed intake (FFI), concentrate feed intake (CFI), total feed intake (TFI), feed conversion ratio (FCR), with T 1 having a higher feed intake on DM basis followed by T2, T4 and T3.The animals with the best FCR and weight gain were those on T4 diets while the T2 animal has the highest final weight. The cost benefit analysis carried out showed that T1 have a higher feed cost compared to (T2). It was concluded that the feeding of green cabbage and lettuce chop with 3% body weight feeding of concentrate led to good performance but better with the feeding of concentrate + cabbage leaves and/ or their mixture with lettuce compared to concentrate + lettuce and the feeding of sole concentrate. The result suggest that supplementing concentrate with cabbage leaves could be used without any detrimental effect on the performance of rabbits. And since the total feed cost was significantly reduced as the concentrate were supplemented with cabbage leaves in the rabbit diets, it thus indicate that it is possible to produce rabbits at relatively cheaper prices when the quantity of concentrate is reduced to 3% of the animal body weight with *ad lib* supplementation with cabbage leave

**Keywords: performance, rabbit, concentrate cabbage lettuce cost saving**

## INTRODUCTION

The increase in human population in Nigeria over the last decades has influenced greatly the demand for food products of animal origin. In consequence this requires a considerable development of animal production. Small scale rabbit projects are gaining international attention day by day as a means of alleviating poverty threat (FAO, 2009). Feed is the single largest operating expense in producing a fryer, it is therefore important to use a sound feeding program (Smith, 2014). It is important to reduce reliance on expensive concentrate diets in feeding of rabbits and so the assessing of the use of forages in combination with concentrates in order to improve productivity and profitability. Studies investigating the effect of feeding concentrates in combination with grass and legume on performance of grower rabbits have been carried out.

Forage use in feeding rabbits is a common practice (Ikyume *et al*, 2019). Rabbits are herbivores and will consume large quantities of forage (greens), which people do not eat and convert this forage into valuable meat for human consumption. The use of compounded concentrates alone has also not given optimum results neither because the use of high concentrates and low forage levels currently practiced by rabbit farmers leads to high cost of production, thus high cost of rabbits. Commercial rabbit pellets that meet the nutrient requirements of rabbits in different stages of production are available in the market. (Moreki, 2007) Availability of high-quality feeds is a major constraint for improved livestock productivity in Africa (Nkosi and Meeske, 2010). In combination with the unaffordable feed costs in this country, resource-poor farmers are resorting to whatever resource is available to feed their animals. It is important to find affordable alternative feed sources that can be fed to livestock to improve production. Nigeria (Plateau state) is endowed with vegetable and fruit by-products that are firstly derived from processing of food for human consumption or discarded for poor quality and or damaged during harvest which can be used for animal feeding. These by-products are important sources of supplementary protein, vitamins and minerals for animals in developing countries Incorporation of these by-products in the diets of ruminants has been reported to reduce the risk of acidosis, which is associated with high grain diets (Ferreira *et al*., 2011). Discarded cabbage can be included in finishing diets for lambs (Nkosi *et al.,* 2016). Discarded cabbage and Lettuce are vegetables that is available in the fresh produce markets of Building Material and Bukuru Market in Jos, Plateau State, Nigeria and could be considered a potential non-conventional feed resource for rabbits. The aim of the study were to outline the performance of weaned' rabbits fed concentrate diet supplemented with discarded cabbage and lettuce green foliage and their mixtures with regard to feeding sole concentrate diet.

## MATERIALS AND METHOD

### Experimental Location/ the Study Area

The study was conducted in the rabbitry unit of the Animal Experimental Farm, Federal College of Veterinary and Medical Laboratory Technology (FCVMLT), Vom. Vom town is situated in Jos South Local Government of Plateau State in Nigeria. It lies between latitude 08° 24' N and longitude 008° 32 and 010° 38' E. with an altitude range between 1200 metres and 1829 metres above sea level,the climate has been described as near temperate. The average temperature is between 19°C to 22°C, (Mangai, 2017).

### Experimental animals and Management

A total of forty (40) weaned rabbits, comprising of male sexes and weighing 700g on the average and 6-8 weeks of age were used. The rabbits were allocated to four experimental diet partitioned into four (4)

experimental treatments in a CompletelyThe Cabbage and Lettuce leaves discards Randomised Design (CRD) with ten (10) rabbits perwere collected the previous day washed, air treatment each treatment having five (5) replicates.dried and given to the animal at 8:00 h daily. Two animals constituted a replicate and eachThe forage were provided *ad libitum.* The replicate were housed in a separate hutch raised fromrabbits were divided into 4 treatment groups the floor. Each hutch were provided with aluminumi.e. $T_1$ (Concentrate Diet only), $T_2$ feeders and drinkers for daily provision of feed and(Concentrate + Cabbage leaves) $T_3$ fresh water. The animals were kept for one week(Concentrate + Lettuce leaves). And $T_4$ acclimatization. Initial and weekly weights was(Concentrate + Cabbage + Lettuce). During taken before feeding in the morning (7.00-8.30 am)the feeding time the animal were given the weekly, the quantity of feed supplied to them wasconcentrate ration *ad lib* for those on T1 and weighed every morning and the left over from thefor those in group 2, 3 and 4 were given previous day's feed were weighed and recorded toconcentrate at 3% of animal body weight and determine feed intake. The rabbits were fed andsubsequently the Cabbage and Lettuce leaves assigned diets for 60 days or their mixtures. Water was provided *ad libitum*. The experimental diets formulated with their Proximate and chemical composition is represented in table 1

**Experimental diet preparation and feed formulation**

**Table 1: Gross composition of concentrate Diet**

| **Ingredient** | **%** |
|---|---|
| Maize | 21.20 |
| Maize offal | 44.00 |
| Soya bean Meal(SBM) | 18.00 |
| Wheat offal | 12.25 |
| Fish meal | 2.00 |
| Salt | 0.50 |
| Premix | 0.25 |
| Methionine | 0.25 |
| Bone meal | 1.50 |
| **Calculated Composition (%)** | |
| Crude Protein (%) | 18.00 |
| ME Kcal/Kg | 2517. 00 |
| Crude Fibre (%) | 9.00 |
| Calcium (%) | 0.73 |
| Available Phosphorus (%) | 0.60 |
| Lysine (%) | 0.94 |
| Methionine (%) | 0.50 |

**Laboratory Study**

**Proximate analysis**

Samples of the test ingredients were analyzed for their proximate composition using the procedure of AOAC (1990).The experiment was carried out in the biochemical laboratory of Grand Cereals Nigeria Limited, Jos, Nigeria.

**Production and growth study**

**Feed intake (or feed consumption) and utilisation**

The feed intake for each rabbit was determined by collecting left over feed from feeders each morning at 08:00 hours before feeding. The feed intake is the difference between the remaining and the distributed feed. The Average feed intake (g/d) = (Feed supplied – Feed leftover)/No. of days on trial over the number of rabbits fed on the same period

**Feed Dry matter conversion**

The feed dry matter conversion were calculated when the weight of feed as fed were multiplied by the percentage dry matter content of the feed as fed

**Feed conversion Ratio (FCR)**

The feed conversion ratio was obtained from the ratio of average feed consumption and weight gained of subjects. It is calculated as follows. **FCR** = Average feed intake (g) / Average daily weight gain (g)

**Body Weight and weight gain**

Each replicate were weighed at the beginning of the trial and weekly, thereafter. The gain for each week was obtained by difference. From this, the weight gain per day was calculated as: Average daily weight gain (g/d) = (Final weight – Initial weight)/no. of day(s) on trial**.** The Average Weight Gained (AWG) was determined weekly. It represents the difference between the Average Weight (AWc) of the current week and that of the previous week (AW) It is determined as follows: AWG=AWC-AWP

**Production economics and cost-benefit study**

The prevailing market prices of ingredients used during the period of the study was used for the economic appraisal of the feeds. Economics of production was based on the feed cost per kg diet and feed cost per kg weight gain. The cost analysis of each of the four treatment diets fed to the rabbits were estimated. The cost of each dietary ingredient (₦/kg) was recorded. Then the feed intake of each rabbit for the experimental period were used to multiply the cost per kg of feed to obtain the cost of feed consumed by each rabbit for the duration of experiment.

**Total Fixed and Variable Cost** was calculated to include the cost of weaned rabbit feed consumed, other variable and fixed cost.

**Returns on Feed** were calculated as the difference between the revenue obtained per rabbit and the cost of feed per rabbit

**Gross Margin** is the difference between the revenue and the total variable cost

**Cost saving** was obtained by subtracting the cost incurred for each parameter by rabbits fed the concentrate-forage diet from the cost incurred by those fed the control diets

**Cost benefit ratio** which is the indication of profit or loss incurred was calculated by dividing the cost of production by the revenue generated from sales of rabbits and by products

**Statistical analysis**

The design was a Complete Randomized Design (CRD) and the data obtained were subjected to analysis of variance (ANOVA) Significant differences and among means was separated by Duncan's multiple range tests using the statistical product and service solutions (SPSS) version 23

## RESULT AND DISCUSSION

**Table 2: Chemical composition of concentrate feed, Cabbage and Lettuce leaves**

| Parameters | Concentrate | Cabbage | Lettuce |
|---|---|---|---|
| Crude protein (%) | 17.68 | 18.83 | 21.20 |
| Fat (%) | 6.07 | 2.24 | 2.86 |
| Moisture (%) | 4.6o | 10.08 | 15.07 |
| Ash (%) | 6.37 | 17.18 | 21.60 |
| Fibre (%) | 6.72 | 7.65 | 7.18 |
| Energy(MJ/K Cal) | N/A | 2182.20 | 2122.55 |

**Proximate composition of cabbage, lettuce and the experimental concentrate diet**

The chemical composition of the concentrate, *Brassica oleracea* and *Lactuca sativa* leaves given to the experimental animals were

analysed and the result is as presented in Table 2. The protein, fibre, and energy content of the forages and concentrate mash tend to satisfy the nutrient requirements of the weaner rabbits for optimal growth (Champe and Maurice, 1993). The percentage crude protein in lettuce was the highest, followed by cabbage and concentrate mash in that order. However, the crude fiber content of cabbage was higher than lettuce and concentrate mash. The crude protein value of Cabbage and lettuce (18-20.00 %) observed in this study falls within the range of 13 – 25 % for leguminous plants (Aduku *et al*., 1986). The CP of cabbage in this study was (18.83 %) and this is a little lower than what was reported by Nkosi *et al*, (2016). These differences in protein level might be attributed to source/origin or species or variety of cabbage. The result showed considerable amount of CF in the leaf meal. The crude fibre content of cabbage and lettuce reported in this study was in the range of (7.2-7.7%). And this is high compared to what was obtained by Babalola, (2015) which obtained a CF of 5.48% with cabbage waste. The result of the proximate composition of the experimental concentrate diets is also presented in the Table in which the level of dry matter is (95.4%).The CP is (17.68%). However, the difference in the crude protein content of the concentrate diets and cabbage and lettuce was not very high.

**Table: 3 Growth Performance of Rabbits Fed Concentrate, Cabbage (*Brassica oleracea*) and Lettuce (*Lactuca sativa*) Green Leaf Chop**

| | Dietary Treatments | | | | |
|---|---|---|---|---|---|
| **Parameters indices** | **T1-(C)** | **T2 (C+C)** | **T3 (C +L)** | **T4 (C+C+L)** | **SEM** |
| Initial Body weight (kg) | 0.800 | 0.800 | 0.770 | 0.700 | $0.02^{NS}$ |
| Daily feed intake Kg DM | $0.053^{a}$ | $0.048^{b}$ | $0.044^{d}$ | $0.046^{c}$ | 0.01* |
| Conc. Feed intake Kg DM | $3.169^{a}$ | $1.443^{c}$ | $1.457^{c}$ | $1.580^{b}$ | 0.219* |
| Forage feed intake Kg DM | $0.000^{c}$ | $1.462^{a}$ | $1.179^{b}$ | $1.199^{b}$ | 0.171* |
| Total feed intake Kg DM | $3.169^{a}$ | $2.890^{b}$ | $2.637^{d}$ | $2.779^{c}$ | 0.059* |
| FCR Kg DM | $4.585^{a}$ | $3.479^{b}$ | $3.975^{ab}$ | $3.217^{c}$ | 0.184* |
| Daily weight gain DWG (Kg) | $0.0117^{b}$ | $0.0137^{ab}$ | $0.0113^{a}$ | $0.0143^{a}$ | 0.004* |
| Total weight gain TWG Kg | $0.700^{b}$ | $0.830^{a}$ | $0.670^{b}$ | $0.870^{a}$ | 0.030* |
| Final Body weight (kg) | $1.500^{bc}$ | $1.630^{a}$ | $1.430^{c}$ | $1.570^{ab}$ | 0.030* |

$^{a, b, c \& d}$ means with different superscripts within each row are significantly different at $p<0.05$.

CFI = Concentrate feed intake; FFI =Forage feed intake. TFI = Total feed intake; FCR = Feed conversion ratio (C) = Concentrate only, (C + C) = concentrate + cabbage (C+L) = Concentrate + lettuce, (C+C+L) = Concentrate +Cabbage + Lettuce * Difference is significant at 5 % *= ($p<0.05$)
$^{NS}$ = not significant difference

**Feed Utilization (Concentrate, Forage and Total Feed Intake)**

The value of feed utilization investigated ($p<0.05$) were significant at all levels of vegetable forage and concentrate intake. Among the groups where concentrate were supplemented with forage; T2, T3, and T4 the intake was about half of that of the sole concentrate group (T1) and it showed a significant ($P<0.05$) difference with the concentrate intake increasing linearly from T2, T3 to T4 with values of 1443g, 1457g, and 1580g on DM basis and 1587.2g,

1619.3g and 1755.6g as fed respectively. The highest value of forage feed intake (FFI) was recorded with T3 (19211.7g) followed by T4 (18450g) and T2 (18271.3g) on as fed basis. This shows that intake becomes higher anywhere lettuce is involved compared to cabbage in this experiment. The higher feed intake of rabbits fed with lettuce compared to others may be due to its high moisture content as wet feeding have been reported to increase feed intake (Afsharmanesh *et al*, 2006). The total feed intake (TFI) which also differ significantly (P <0.05) is a true reflection of the trend observed in the forage feed intake as T1 was lowest (3520.4g), then T2 (19858.8g), T4 (20205g) and T3 (20831g) on as fed basis but this trend was different on DM basis as the rabbits on T1 (3.169 Kg) consumed more than the rest of the group with T2 (2.890) T3 (2.637) and T4 (2.778) as the cabbage and lettuce were both low in dry matter. There was a substitution effect where the treatments with the lower forage intake had a higher concentrate intake in comparison to the treatment with the highest forage intake ingesting a lower quantity of concentrate. Gidenne *et al*. (1998,) reported a similar effect for diets high in fibre. From the total feed intake levels recorded in this study in relation to other studies where rabbits were fed concentrate diet in combination with forages, the daily feed intake of the range 44-53 g DMI in this study were far lower than 80-117gDMI obtained by Udeh *et al*, 2007 and 93-101.7g DMI by Paul and Lallo (2016). But on as Fed basis the report from this study (59-347g/day) is similar to the range of 68-350g obtained by Oyebiyi *et al*, 2013 but lower to those (88.2g -500.9g) obtained by Ironkwe and Ukanwoko, (2017) And this report gave a higher level of feed intake on weekly basis in the range of 0.50-2.89Kg as Fed compared to the range of (0,62-1.53 Kg ) that were obtained by Amata and Okorodudu, (2016) and 0.88Kg obtained by Abel *et al*, 2018

**Feed Conversion Ratio (FCR)**

Lower FCR indicate efficient users of feed (Lebas, 1986); Amata and Okerodulu, 2016) The result for the FCR on Kg DMI showed that there was a significant difference (P<0.05) across the treatment groups as T1 (4.6 Kg DM) was higher than the rest of the group, where T2 (3.5 Kg DM), was lower than T3 (3.9 Kg DM) and T4 (3.2 Kg DM) having the lowest value. As the Feed conversion ratio differed significantly (P <0.05) between treatments, with some of the results been in agreement with Villamide *et al*.,(1998) and Maertens (1998) who reported that FCR levels for growing rabbits should range between 3.0 and 3.5. The best FCR (3.2KgDMI) for this study was obtained for rabbits fed a mixture of cabbage and lettuce supplemented with concentrate diet. Harris *et al* (1984) also reported higher feed conversion ratio on mixed feeding of free choice hay and pellets than sole pellets

**Initial Weigth Final Weight and Weight Gain**

The animals were carefully selected and balanced for weight for the research and this was reflected well as there were no significant difference between the various groups studied. The final weight values obtained from this study (P<0.05) shows some level of significant difference as the highest value of final weight were obtained with T2 (1.63 Kg) followed byT4 (1.57 Kg) and T1 (1.50Kg) and the lowest values was that of T3 (1.43 Kg). In relation to initial weight values and values obtained at final weight, those groups with similar initial weight (T1 and T2) and (T3 and T4) all ended up having dissimilar final weight just as groups with different initial weight (T2 and T3) This has really shown that the beginning does not determine what the end would be when animals are treated to different levels of dietary treatment or the same level of dietary treatment even as other factors such as

breeds, age and health conditions can affects them. With regard to the amount of feed intake, the final weight of the animals in T3 which had more feed intake would have been expected to have a higher final weight since the CP level of the different treatment were similar but final weight is not just affected by intake and CP level alone but also the amino acid profile (Forbe, 1995). In comparism to result obtained from similar studies, the final weight value ($p < 0.05$) of the range of 1.43 - 1.63 obtained in this study fell within the normal gross weight of rabbit (1.4-3.5) reported by Brown *et al*, (1998) and is similar to that recorded by Udeh *et al,* (2007) and Nwagu *et al*, (2010) which obtained 1452-1630g and 1.45-1.54 Kg respectively but lower than the results obtained by Ironwkwe and Ukanaroko, (2017) working with pure New Zealand white does and Paul and Lallas , (2017) which obtained a higher value of 2887.5-3075g and 2228-2424g respectively. But the result obtained in this study was higher than those from Oyebiyi *et al*, (2013) were supplementation was based on skipping days in feeding concentrate diet with forage given *ad lib*. The value of final weight obtained from that study was in the range of 948-1385g. Abel et al, 2018 also recorded a slightly lower final weight of the range (1586.74-1610.47g) compared to this study. The total weight gain of the experimental animals were as reported in table 3. The total weight gain from T4 (0.87) and T2 (0.83) has the highest value with T4 been numerically higher than T2 even though T2 had a higher initial and final weight value than T4. This higher final weight in T2 compared to T4 who has a better weight gain could be due to the higher initial weight of T2 as both nutritional and genetic factor would have contributed also. Meanwhile on the other hand T1 and T3 had similar weight gain values lower than T2 and T4 with T3 having the least value even though T3 had the highest total feed intake on as fed basis but not with a corresponding higher DMI. The rabbits on the concentrate-forage based diet (T2, T3, and T4) had a better weight gain than those on sole concentrate (T1) and this agrees with the observation of Lorgver *et al*, (2008) which shows that feeding rabbits with these forages supplemented with some concentrate could result in comparable daily weight gain obtainable in most studies in the tropics. Among the animals that were fed the concentrate–forage based diet those that were given concentrate with a mixture of cabbage and lettuce (T4) performed better in weight gain and this has been shown by Minereole *et al*, (2011); Singh *et al*, (2007) that rabbit perform better when fed rations mixed with concentrate and leaves of plants (Amata and Okorodudu, 2016). The numerical value of the daily weight gain obtained from this study in the range (11-14g) compare favourably and slightly above those obtained by Ikyune *et al*, (2019); Kagya-Agyemong *et al*, (2013) which ranges from (3.47-14.41g) and (9.6-12.4) respectively. But the value obtained here were higher than those of Nwagu *et al*., 2010 and Abel *et al*, (2018), which obtained values of 4.58-11.86g, and 11.57-11.96 respectively.

**Table 4: Cost-Benefit Analysis of Rabbit Production Fed Concentrate Supplemented with Cabbage and Lettuce Green Leaf Chop**

| | Dietary Treatments | | | | |
|---|---|---|---|---|---|
| **Parameters** | **T2-(C)** | **T2 –(C + C)** | **T3 –( C+ L)** | **T4 (C+ C+ L)** | **SEM** |
| Total Feed Intake (Kg) As Fed | 3.5204$^{c}$ | 19.8586$^{bc}$ | 20.831$^{a}$ | 20.2057$^{b}$ | 2.196* |
| Cost of concentrate feed intake(₦/Kg) | 381.3$^{a}$ | 172.8$^{b}$ | 172.8$^{b}$ | 190.8$^{c}$ | 26.56* |
| Cost saving on concentrate feed (₦) | -$^{c}$ | 208.5$^{a}$ | 208.5$^{a}$ | 190.5$^{b}$ | 26.56* |
| Cost of forage feed intake(₦/Kg) | 0$^{d}$ | 126$^{c}$ | 502.67$^{a}$ | 297.0$^{b}$ | 56.94* |
| Total feed cost (₦/Kg) | 381.3$^{c}$ | 298.8$^{d}$ | 675,47$^{a}$ | 487.8$^{b}$ | 42.52* |
| Cost saving on total feed cost (₦) | 0.00$^{c}$ | 82.53$^{d}$ | -294.13$^{a}$ | -106.46$^{b}$ | 42.54$^{NS}$ |

| | | | | | |
|---|---|---|---|---|---|
| Total cost TC(₦) | 1931.33[c] | 1848.80[d] | 2225.47[a] | 2037.8[b] | 42.52* |
| Cost saving on total cost (₦) | 0.00[b] | 82.5[a] | -294.13[d] | -106.47[c] | 42.57* |
| Feed cost as percentage of total cost (₦) | 19.70[b] | 16.20[c] | 3.00[d] | 23.97[a] | 1.57* |
| Total Weight gain TWG (Kg) | 0.70[b] | 0.83[a] | 0.67[b] | 0.87[a] | 003* |
| Final weight FW (Kg) | 01.50[ab] | 1.63[c] | 1.43[a] | 1.57[bc] | 003* |
| Total revenue(₦) | 2265.30[ab] | 2486.3o[a] | 2206.70[c] | 2373.30[bc] | 36.29* |
| Return on feed(₦/Kg) | 1884.00[b] | 2187.50[a] | 1531.20[d] | 1882.20[c] | 71.65* |
| Gross margin(₦/Rabbit) | 484.00[b] | 787.50[a] | 131.20[c] | 485.50[b] | 71.71* |
| Profit (₦/Rabbit) | 334.00[b] | 637.89[a] | -18.80[c] | 335.50[b] | 71.72 |
| Cost/benefit ratio | 0.85 | 0.75 | 1.01 | 0.86 | 0.029 |

[a, b, c & d] means with different superscripts within each row are significantly different at $p<0.05$.

(C) = Concentrate only, (C + C) = concentrate +total cost of feed for the control diet was ₦381.3 per cabbage (C+L) = Concentrate + lettuce, (C+C+L) =rabbit which was higher than those of the concentrate Concentrate +Cabbage + Lettuce SPRFW=Sellingtaken by those on the concentrate-forage based diet price of rabbit at final weight which cost between ₦172.8 and ₦190.5, this result *= ($p<0.05$).NS= Not significant to a cost saving of ₦190.5 to ₦208.5 due to supplementing concentrate with forage. The total

**Cost Benefit Analysis**

The cost benefit analysis of feeding sole concentratecost of feeding with concentrate supplemented with and the concentrate-forage based diet is as shown incabbage green leaf chop was lower than any the able. The economic analysis of the feed costexperimental diets. This has resulted to a cost saving shows that the estimated return per total weightof ₦82.5 per rabbit and also a corresponding cost gained declined progressively as the cabbage wassaving of the total cost of production (₦82.5) added i.e. the cabbage supplemental level increases

**Revenue**

among the group where concentrate wasRevenue obtained from the sale of the rabbits fed supplemented with cabbage. The cost of feed wascontrol diet was less than those fed T2 and T4 diets highest ($p<0.05$) for T3 and reduced in the order ofbut was more than T3. Revenue less total cost of T3, T4, T1 and T2. And that means that theproduction was higher and there was more return supplementation of concentrate with cabbagefrom the production of T2 rabbits than T1 or T4 and reduces cost of feeding while supplementation withT3 which is a reflection of the difference in weight lettuce increases cost of feeding. The lower cost ofgain and cost compared to T1 and T3 but was only a the diets supplemented with cabbage observed in thisreflection of cost of forage compared to T4 which study can be ascribed to low cost of discardedeven had a better weight gain to T2 cabbage compared to lettuce. Discarded cabbage are

**Profit/ Cost-Benefit Ratio**

usually cheaper as feed components when not inCost benefit ratio was less than one in all the competition for other uses such as human food orexperimental treatment of T1, T2 and T4 with T2 industrial raw materials. The reduction of feed costhaving the lowest value. But T3 has a value above because of the use of cabbage waste by products inone which is an indication of no profit the diet has been reported by other researchers

**Conclusion**

**Cost of Production**

With rabbits been herbivorous in nature and The total cost of production was highest for T3from the experiment carried out, it has clearly followed by T4, T1 and T2 having the lowest cost ofshowed that rabbits can be raised on equal production. ratio of concentrate to cabbage and lettuce on dry matter intake level or a reduced quantity

**Cost Saving**

Cost saving was obtained by subtracting the costof concentrate to 3% of the body weight of incurred for each parameter by rabbit fed thethe rabbits with *ad lib* feeding of vegetable concentrate forage based diets from the cost incurredforage can be practiced without any adverse by those fed the control diet (sole concentrate). Theeffect on the animals. Good performance

without corresponding economic returns or gains is worthless and of low value, therefore for optimal performance and outmost profit maximization, concentrate should be supplemented with cabbage leaves only while lettuce should be used in combination with other high quality forage or vegetable by-product rather than using it alone in order to reduce their high cost while utilizing their good nutritional qualities

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