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# The Effect of cassava grits and Local Maize alone or the combination on the performance of Broilers at Animal Production Division Njala University

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## ABSTRACT

A seven-week study was carried out using -day old chicks. Thirty chicks were assigned to a pen in a large room with each chick having a floor space of 2sq.ft. To evaluate the effect of cassava grits and maize alone or the combination on the growth performance of Broilers
The chicks were fed ad-lib. The birds were weighed weekly and weight gained was recorded. Variables measured included feed intake, water intake, weight gain, feed conversion efficiency, morbidity, mortality, and economic impact.
The effect of maize and cassava alone or in combination as energy source for broilers was tested. The two rations namely wheat meal feed and imported broiler concentrates were added to the cassava grit and maize as indicated in the study.
All the rations contained nearly equal amounts of protein but the inclusion rates of concentrates and wheat meal feed differ. Also oyster shell was added to treatment A in order to meet calcium requirement but the requirement for phosphorus was highest for treatment C. The content of lysine and methionine vary from 1.42, 1.78 and 0.9 respectively. These were above normal requirement to the stated nutrients.
Result indicated that feed intake did not differ much but it tended to be highest in treatment C which contained only maize. This was followed by treatment B and it was lowest in treatment A. Weight gains did not also differ much. They tend to be highest in treatment C followed by treatment B and lowest in treatment A. Water intake was highest in C followed by B and then A.
Conclusively with regards, weights and water intake, the cassava containing diets (A and B) were much inferior compared with maize. This was clearly proven by the linear regression imposed with regards weights. The A and B rations though inferior were not significantly

different from the result obtained from C. In fact, in the earlier ages of the birds there was no marked difference between all the three treatments. The differences between C and others became pronounced only after four (4) weeks and increasingly so afterwards.
The cost of various rations showed that ration B (cassava and maize in combination) was higher in cost followed by A and C. Treatment C had the lowest inclusion rate of concentrate and thus the price per 50kg which is NLe158.34 was lowest. Therefore, the limiting factor in the preparation of feed for poultry is concentrates and it cost is exorbitant.
With regards feed cost, ration A was the most expensive but less superior. Ration C was the least expensive but the most superior. However, the high cost of maize may be escalated by substantial losses during storage; also availability of this product may be strictly seasonal thus nullifying the benefit. Or economic returns.in the use of maize.

## 1.1 Introduction

Basal feed for non-ruminants particularly broilers vary from country to country depending on the types of feedstuffs available and the significance of such feedstuffs for both humans and livestock nutrition. Basal feed for non-ruminants, particularly broilers, is a critical aspect of poultry nutrition that focuses on providing the essential nutrients required for optimal growth, health, and production efficiency. The formulation of basal feeds typically includes a combination of energy sources, protein sources, vitamins, and minerals. (James R. Gillespie, 2022).

Maize is the most commonly used energy source for poultry feeding worldwide due to its high metabolizable energy content. However, the high cost and limited supply of maize, especially in regions like Tanzania, necessitate the search for alternative feedstuffs. (James R. Gillespie, 2022). Cassava, a crop with high energy content and the ability to grow in less fertile soils, is a promising alternative. (James R. Gillespie, 2022).

Several studies have explored the use of cassava as a replacement for maize meal in poultry diets. Cassava tubers have high ME; however, their inclusion in poultry diet is restricted because of their low protein content, the unbalanced amino acid profile, the high fiber content and the presence of anti-nutrients, particularly cyanogenic glucosides. (Zubair M., 2014)

The primary energy sources in broiler diets are cereal grains such as corn and wheat. These grains provide carbohydrates that are crucial for energy metabolism. These grains are favored due to their high energy content, which is essential for the growth and development of broiler chickens. Corn is particularly prevalent in the United States and other regions where it is either grown or imported for livestock feed. Wheat, while containing more protein than corn, has a slightly lower energy density but is also widely used in poultry diets, especially in Europe. (Wu, Y., et al., 2020), (Mateos, G. G., et al, 2019)

The digestibility and metabolizable energy (ME) of these grains can vary based on factors such as the age of the birds and the specific characteristics of the grain itself. Understanding these variations is crucial for formulating effective and efficient poultry diets. (Wu, Y., et al, 2020)

In tropical regions, alternative energy-rich feeds such as sugar cane products and by-products from oil palm are increasingly being utilized to support the growing demand for biofuels and other renewable energy sources. The use of these crops is driven by their high productivity and economic viability compared to traditional fossil fuels. (Journal of Cleaner Production, 2016)

Sugar cane, for instance, is not only a source of sugar but also a significant feedstock for ethanol production. Ethanol derived from sugar cane is considered one of the most efficient biofuels due to its favorable energy balance and lower greenhouse gas emissions compared to gasoline. Similarly, oil palm by-products, including palm kernel cake and empty fruit bunches, can be repurposed as animal feed or converted into bioenergy through various processes. (Oil Palm." Encyclopedia of Agriculture and Food Systems, 2014)

The cultivation of these crops in tropical regions has implications for land use, biodiversity, and local economies. While they provide an opportunity for sustainable energy production, there are concerns about deforestation and environmental degradation associated with large-scale agricultural practices. Therefore, it is essential to balance the benefits of utilizing these alternative feeds with the need to protect natural ecosystems.

The formulation of basal feed must consider factors such as age of the birds, growth stage (starter, grower, finisher), environmental conditions, and specific production goals (meat quality vs. growth rate).

In many regions, especially in developing countries or tropical areas, there is an increasing focus on utilizing locally available feed resources to reduce costs and improve sustainability in poultry production systems.

Cereals such as maize, barley, wheat, oats, and rice are mostly used in many countries for both livestock and humans where their production is high.

In Sierra Leone the primary basal feedstuff for poultry feeding is maize which had been used for years. This is due to its high energy content and availability, making it a crucial component in the diets of poultry. The significance of maize in poultry nutrition is underscored by its role in reducing production costs and enhancing the profitability of local poultry farming. (Pratt, Avril, 2020), (Invest Salone Initiative Report on Local Feed Production in Sierra Leone, 2022)

Most often in other African countries other types of cereals are fed to poultry. However, the choice depends largely on the staple food of that country. In developed countries where mechanization is improved, cereal crops are produced purposely for poultry feeding.

Most poultry farmers in Sierra Leone mix basal feedstuff with imported protein concentrates and other feed supplements to prepare feed rations. Protein concentrates used are oil seed meals obtained from solvent extraction of some seeds like cotton seed, groundnut, sesame seed etc. These are used as plant protein sources in poultry feeding. Poultry farming in Sierra Leone, like in many other regions, relies heavily on the formulation of balanced feed rations to ensure optimal growth and productivity of birds. The practice of mixing basal feedstuffs with imported protein concentrates and other feed supplements is a common strategy employed by poultry farmers to enhance the nutritional quality of the feed. (Akinola, Adebayo O., et al. 2020.)

The practice of mixing basal feedstuff with imported protein concentrates and supplements is vital for enhancing poultry productivity in Sierra Leone's agricultural landscape. It reflects a broader trend where local farmers adapt their feeding strategies based on available resources while striving to meet the nutritional needs of their livestock. (Food and Agriculture Organization .2019)

The high cost of poultry feed especially maize and other cereals stirs up interest in considering cassava root as being a potential substitute for maize as a dietary energy source for feeding poultry.

The maize that is used in animal feed is mainly produced by local farmers by intercropping with rice. The price for maize is exorbitant particularly during the planting season. A bag of 85kg to 90kg of maize cost NLe 800 to NLe 900 ($38). Therefore, alternative energy sources for basal feeds must be exploited for non-ruminants. Locally produced feedstuffs could be made available for formulating theoretically balanced rations for chickens with emphasis on common tubers as energy source.

Cassava, sweet potatoes or a combination of both are considered suitable alternatives. Cassava (Manihot esculenta) and sweet potatoes (Ipomoea batatas) are two important root crops that serve as staple foods in many tropical and subtropical regions of the world. Both crops are valued not only for their caloric content but also for their versatility in various culinary applications. When considering their suitability as alternatives to other food sources, it is essential to examine their nutritional profiles, particularly their dry matter content. These in their raw state may contain low percentage dry matter: 35% for sweet potatoes and also 35% for cassava. However, the price per ton of dry weight is much lower than maize. Cassava has additional advantage over maize because it can be easily preserved, stored in the field as crop, harvested and used as fresh when needed unlike maize which can be spoilt by weevils and by high moisture content. (Reddy, K.R., et al., 2010), (Sweet Potatoes: Health Benefits (2010)

However, maize is rich in carbohydrates and fat but this cannot be feed alone to poultry because it is deficient in certain amino acids such as lysine. It can be mixed with other protein sources rich in lysine example soybean.

**1.2. OBJECTIVES OF THE STUDY**

The main objective of this study is to determine the effects of using maize and cassava as energy sources in broiler rations.

The Primary objectives are:

1. To evaluate the growth performance of broilers fed diets containing cassava grits alone, maize alone, and a combination of both.

This includes measuring parameters such as weight gain, feed intake, and feed conversion ratio.

2. To assess the effects of cassava grits and maize-based diets on the overall health and mortality rate of broilers.

This involves monitoring any health issues or death rates during the feeding trial

3. To assess the economic impact of replacing maize with cassava grit in broiler diets, considering feed costs and weight gain

**1.3. STATEMENT OF THE PROBLEM**

The poultry industry heavily relies on maize as a primary energy source in broiler diets, but its high cost and competition with human consumption and other uses, such as bioethanol production, necessitate the exploration of alternative feedstuffs. (Tewe, O. O., and S. S. D. Rajaguru 2022). Cassava, a readily available and energy-rich crop, presents a viable alternative, particularly in regions where maize is scarce or expensive. ( Tewe, O. O., and S. S. D. Rajaguru 2022).

However, the inclusion of cassava in broiler diets can be limited by its lower protein content, unbalanced amino acid profile, and the presence of anti-nutritional factors, such as cyanogenic glucosides.( Ahiwe, E.U., Omede, A.A., Abdallh, M.B., Iji, P.A. (2018)]. Processing methods and enzyme supplementation can mitigate these limitations.[ Ahiwe, E.U., Omede, A.A., Abdallh, M.B., Iji, P.A. (2018 .

This study aims to investigate the effects of replacing maize with varying levels of cassava grits on the performance of broiler chickens, including feed intake, weight gain, feed conversion ratio, carcass characteristics, and economic efficiency. The central question is: What is the optimal level of cassava grit inclusion in broiler diets to maximize performance and economic returns while maintaining or improving carcass quality?

**1.4. RESEARCH QUESTIONS**

What is the effect of different levels of cassava grit (0%, 25%, 50%, 75%, and 100% replacement of maize) on the feed intake of broiler chickens?

How does the inclusion of cassava grit affect the body weight gain and feed conversion ratio of broiler chickens?

What are the effects of cassava grit inclusion on carcass characteristics, including dressed weight, breast yield, and choice cuts?

What is the economic impact of replacing maize with cassava grit in broiler diets, considering feed costs and weight gain?

Does the inclusion of cassava grit affect the bone quality and mineral composition of broiler chickens?

Does the inclusion of cassava grit affect the energy retention of broiler chickens?

**1.5. Significance of the Study:**

This study will provide valuable information on the optimal use of cassava grits as a replacement for maize in broiler diets. The findings will benefit poultry farmers by offering a cost-effective and sustainable alternative feed ingredient, potentially reducing feed costs and improving profitability. The study will also contribute to the body of knowledge on alternative feed resources for poultry production, particularly in regions where maize is scarce or expensive. The results of this study will be useful in introducing a new energy source (cassava) to the poultry industry in Tanzania and other countries which produce cassava on a commercial basis.

**1.6. Justification**

✔ It addresses feed cost reduction by evaluating cassava as a maize alternative.

✔ It ensures feed security by diversifying energy sources.

✔ It assesses nutritional impacts on broiler growth and health.

✔ It examines processing needs to mitigate cassava’s anti-nutritional effects.

✔ It enhances economic viability for poultry farmers.

✔ It promotes sustainable feed sourcing in poultry production.

By comparing cassava grits, maize alone, and their combination, the research will provide practical recommendations for optimizing broiler diets.

**1.7. LIMITATION**

1. The research was limited to feedstuffs such as cassava grits, and maize
2. Sample Size and Selection: The number of birds was limited due to logistical challenges, such as accessibility to good heathy birds
3. Resource Limitations: Financial constraints may limit the scope of research activities, including experimental procedure, cost of feed used and equipment

**1.8. DELIMITATION**

1. Focus on Specific feedstuffs: The study specifically targets cassava grits and maize farmers, excluding other feedstuffs that might also benefit the research. This focus allows for a more detailed analysis but limits to only cassava grits and maize which may have broaden applicability of the research.
2. Target Population: The research was confined to poultry birds within Njala University whose research was carried out at the Animal Science Department, thereby excluding larger commercial farms or those who do not engage with these services.
3. Time Frame for Data Collection: The research was conducted within a specific time frame, which helps streamline data collection but may be very difficult to undertake certain activities such as drying of the feed during the raining season which delay the drying process due to high moisture.

## METHODOLOGY

### 3.1. Introduction

Maize is a primary energy source in poultry diets, but its high cost necessitates exploring alternative feedstuffs like cassava grits. Cassava, a readily available crop in many tropical regions, offers a potential alternative due to its high starch content. However, cassava has limitations, including low protein content, an unbalanced amino acid profile, and the presence of cyanogenic glucosides, which can be toxic to animals. Processing methods like drying, fermentation, and enzyme supplementation can mitigate these issues.

### 3.2. Materials and Methods

### 3.3. Feedstuffs used

The carbohydrate sources used in this experiment are maize and cassava which are either used separately or in a one or two mixture. Wheat meal feed was also used as well as protein concentrates.

### 3.4. Preparation of the Feeds

Dried maize grains were obtained from Crop Science Department School of Agriculture Njala University. The maize was ground to moderate particles (not too fine and not too coarse) using a grinder obtained from the Animal Science Department Njala University.

Fresh Cassava was also obtained from crop science department. It was peeled, cut into thin irregular sizes- flakes and sun dried on hardened ground, mats and roof-top of corrugated iron sheets. The cassava flakes were dried for a period of one to three weeks, depending the intensity of the sunshine and the quantity of flakes spread on the mats of sheet.

Some of the chips that were dried during the raining season took more than two to three weeks to dry so that the moisture content could reduce for storage. During storage some of the chips were mold-infected and had to be disposed of. The flakes were then ground and put in plastic bags and stored in well disinfected rooms until ready for use.

Wheat meal feed was also machine ground. Oyster shells were added to supplement for calcium. The various ingredients were measured separately and then mixed to form the ration.

**Table 1. Composition of Rations**

| INGREDIENTS | TREATMENTS(Kg) | | |
|---|---|---|---|
| | A | B | C |
| Cassava | 125 | 60 | - |
| Maize | - | 60 | 125 |
| Concentrate | 95 | 90 | 70 |
| Wheat meal feed | 80 | 90 | 93 |
| Oystershell | - | - | 2 |
| TOTAL | 300 | 300 | 300 |

**Table 2. APPROXIMAE COMPISITION OF THR RATIONS**

| CONSTITUENTS | A | B | C |
|---|---|---|---|
| Energy (Kcal/Kg) | 2854.5 | 2770.8 | 2638.1 |
| %Protein | 21.94 | 22.12 | 20.92 |
| %Calcium | 1.15 | 0.98 | 1.00 |
| %Phosphorus | 0.74 | 0.706 | 0.62 |

| | | | |
|---|---|---|---|
| %Lysine | 1.41 | 1.3 | 1.02 |
| %Meth + Cystine | 1.29 | 0.88 | 0.77 |

### 3.5. Experimental Procedure and parameters

Ninety-day old chicks were used in the experiment. Thirty chicks were assigned to a pen in a large room with each chick having a floor space of 2sq.ft.

Partitions made up of boards and wire mesh were thoroughly cleaned and disinfected. The bedding floor covered with wood shavings which absorbs droppings and urine.

A 7-week feeding trial was conducted to assess the performance and economy of production of broilers fed cassava grit-based diets. Cassava grit replaced maize at various levels (0%, 25%, 50%, 75%, and 100%), creating three experimental diets. A control diet (Diet 1) was 100% maize-based. Parameters considered included initial weight, final weight, feed intake, Feed Conversion Ratio (FCR), and economy of production

Feeds and water were placed in feeders and drinkers respectively. The chickens were fed ad-lib (unrestricted feeding). Drugs were administered by diluting in drinking water or mixed in feed. Day old chicks were given tetracycline at 250mg.per liter of water. At four to five weeks old Piperazine was given at two table spoons full per four gallons of water. The feed was measured daily. Water intake was also recorded. The residues or left over were measured daily and recorded. Weekly data showed weekly feed intake in kg, water intake in mls. The birds were weighed weekly and weights and weight increases were recorded.

## RESULTS

### 4.2. Feed intake

Average feed intake increased by bird ($p<0.001$). Treatments barely affected the feed intake per bird ($p<0.1$). Birds on treatment C tend to consumed more feed than those on treatments B and A. The feed consumption rate on B is greater than feed intake of birds on treatment A, this is confirmed by LSD imposed.

**Table 3: Mean Feed intake per bird per week**

| Treatments | WEEKS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Total | Means |
| A | 0.124 | 0.220 | 0.290 | 0.500 | 0.620 | 0.83 | 0.93 | 3.514 | 0.502 |
| B | 0.145 | 0.220 | 0.300 | 0.445 | 0.690 | 0.86 | 1.03 | 3.690 | 0.527 |
| C | 0.128 | 0.240 | 0.330 | 0.522 | 0.78 | 0.88 | 0.94 | 3.820 | 0.545 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| TOTAL | 0.397 | 0.680 | 0.920 | 1.467 | 2.090 | 2.570 | 2.90 | 11.024 | 0.524 |

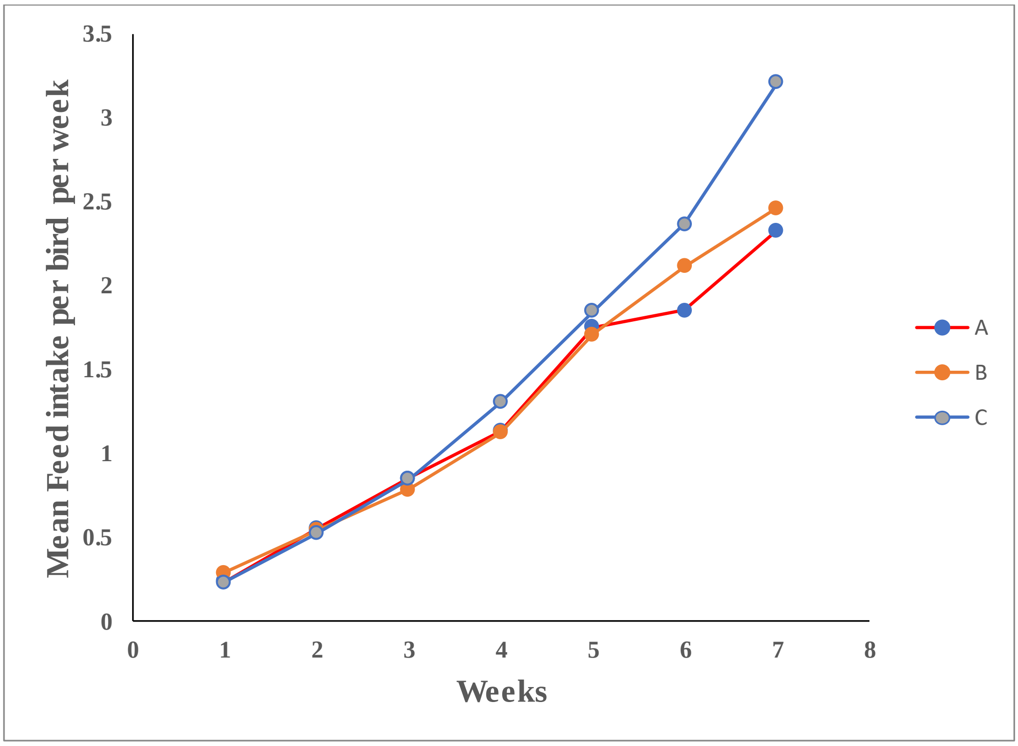


FIGURE 1: Mean Feed Intake by Bird/week

Average feed intake increased by bird (p<0.001). Treatments barely affected the feed intake per bird (p<0.). Birds on treatment C tend to consumed more feed than those on treatment B and C. The feed consumption rate on B is greater than feed intake of birds on treatment A, this is confirmed by LSD imposed

**4.3. WEIGHT**

**TABLE 4: Mean weekly weight gain (Kg)**

| Treatments | WEEKS | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Total |
| A | 0.054 | 0.107 | 0.196 | 0.459 | 0.80 | 1.13 | 1.40 | 4.146 |
| B | 0.054 | 0.107 | 0.196 | 0.419 | 0.85 | 1.20 | 1.50 | 4.326 |
| C | 0049 | 0.099 | 0.241 | 0.544 | 1.02 | 1.40 | 1.80 | 5.153 |

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| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| TOTAL | 0.157 | 0.313 | 0.633 | 1.422 | 2.67 | 3.73 | 4.7 | 13.625 |

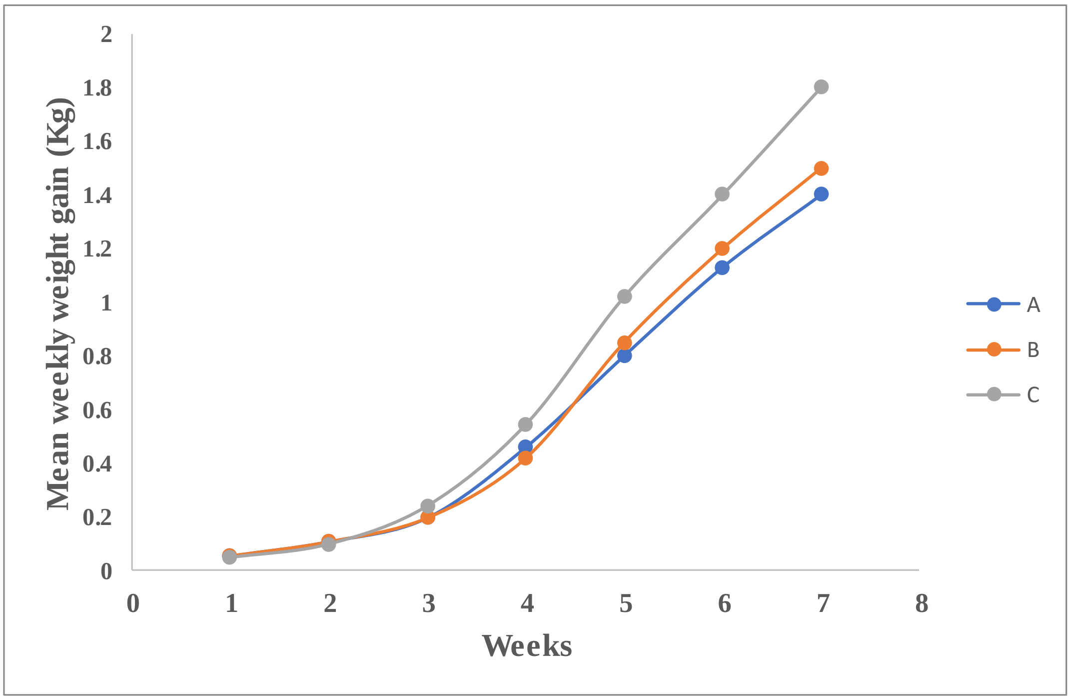


FIGURE 2: MEAN WEIGHT GAIN

Weeks progression significantly increases weights ($p<0.001$). Treatment differences were barely significant ($p<0.1$). The correlation coefficient for treatment A, B, and C were 0.96, 0.97 and 0.98 respectively. A correlation coefficient of 0.96 indicates a very strong positive linear relationship. A correlation coefficient of 0.97 suggests an even stronger relationship with a steeper slope. A correlation coefficient of 0.98 reflects an extremely strong relationship where changes in one variable almost perfectly predict changes in another.

These interpretations highlight how closely related two variables are and how effectively one can predict outcomes based on another when dealing with high correlation coefficients. However, their respective slopes varied. The linear regression curve for treatment C had the highest sloop. During the first few weeks of life the differences in the growth rates of the birds were not much distinguishable. By the third week the curves start spreading out. By the fourth week the spread was quite noticeable and by the seventh week the curve for treatment C was quite distinct from those of treatments A and B. But there were still small differences between A and B. B being above A, as indicated in their slopes.

The differences in the weights of birds as in the case of food intake could not be due to protein content (this was nearly the same in all treatments) or the content of the other essential nutrients i.e calcium, phosphorus, lysine, methionine and cysteine. These were all supplied above recommended requirement. The only explanation is that birds on treatment C consumed more food and are therefore expected to put on more weight. The mean final weight of the birds on treatment C was 1.8kg in week 7 compared with 1.40kg and 1.50kg for treatments A and B respectively. (Table4).

### 4.4. Water Intake

**TABLE 5: Mean Weekly Water Intake per Bird in Liters**

| Treatments | WEEKS | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Total |
| A | 0.237 | 0.522 | 0.855 | 1.132 | 1.754 | 1.854 | 2.327 | 8.681 |
| B | 0.290 | 0.544 | 0.785 | 1.126 | 1.771 | 2.113 | 2.462 | 9.091 |
| C | 0.233 | 0.524 | 0.847 | 1.304 | 1.850 | 2.369 | 3.212 | 10.339 |
| TOTAL | 0.760 | 1.590 | 2.487 | 3.562 | 5.375 | 6.336 | 8.001 | 28.111 |

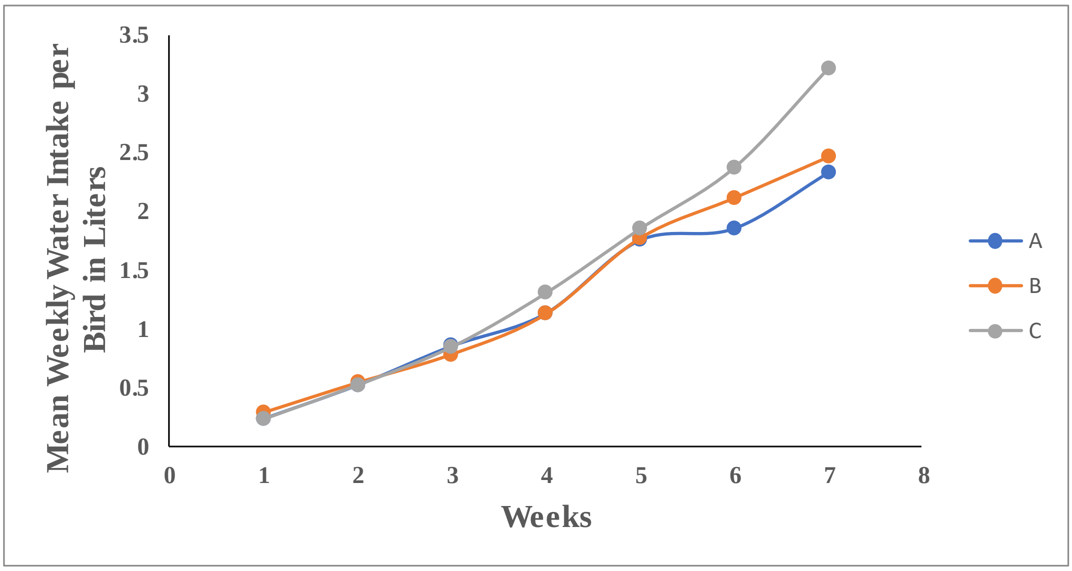


FIGURE 3. Mean Weekly Water Intake per Bird in Liters

The result shows that treatment differences are barely significant ($p<0.1$). Weeks progression significantly increased water intake ($p<0.001$). A reflection of the increased water intake with weeks

### 4.5. COST ANALYSIS

Cost of day-old chick at NLe237 each for 90 chicks= NLe21,330

### 4.6. Cost of Feed

**TREATMENT A**

Ingredients %/100 Nle/1000 Product (Nle)

| | | | |
|---|---|---|---|
| Cassava | 0.4 | 370 | 150 |
| Maize | ………. | ……….. | ………. |
| Concentrate | 0.35 | 5400 | 1890 |
| Wheatmeal | 0.25 | 300 | 75 |
| Oyster shell | …… | …………. | …………. |
| 4.7. Cost of Ingredients | 2,115 | | |
| Labor Cost | 9,000 | | |
| Cost per ton | 3,015 | | |
| 30% Profit | 9045 | | |
| Price per ton | 12060 | | |
| Price per 50kg | 603 | | |

**4.8. TREATMENT B**

| INGREDIENTS | %/100 | Nle/ton | PRODUCT (Nle) |
|---|---|---|---|
| Cassava | 0.2 | 370 | 74 |
| Maize | 0.2 | 720 | 144 |
| Concentrates | 0.3 | 5400 | 1620 |
| Wheatmeal Feed | 0.3 | 300 | 90 |
| Oyster Shells | ………. | …………. | ……………. |

| | |
|---|---|
| 4.9. COST OF INGREDIENT | 1928 |
| Labor | 9,000 |
| Cost/ton | 2,828 |
| 30% | 8484 |
| Price /ton | 3676.4 |
| Price/50kg | 183.82 |

**4.10. TREATMENT C**

| 4.11. INGREDIENTS | %/100 | Nle/ton | PRODUCT (Nle) |
|---|---|---|---|
| Cassava | ……… | ……….. | ………….. |
| Maize | 0.4 | 720 | 288 |
| Concentrates | 0.21 | 5400 | 1134 |
| Wheatmeal Feed | 0.38 | 300 | 114 |
| Oyster Shells | 0.001 | …………. | ,…… |

| | |
|---|---|
| 4.12. COST OF INGREDIENT | 1536 |
| Labor | 900 |
| Cost/ton | 2436 |
| 30% Profit | 730.8 |
| Price /ton | 3166.8 |
| Price/50kg | 158.34 |

### 4.13. COST OF FEED

The concentrates are currently the sole source of protein for animal feeding. Hence to reduce feed cost, local protein sources must be exploited. This could be done by using combination of vegetable proteins like groundnut cake, and sesame seed cake, peas of beans. Presently groundnut cake and sesame are not available in abundance but there is potential for their production for commercial use in animal feeding. Most beans are used for animal feeding and their high cost may be prohibited for use as animal feed especially in low-income farming enterprise.

## 5.1. DISCUSSION, CONCLUSION AND RECOMMENDATIONS

### 5.2. DISCUSSION

The formulation of cost-effective and nutritionally adequate diets is paramount in broiler production, with energy sources constituting the largest proportion of feed ingredients. Maize (corn) has historically been the predominant energy source in poultry diets globally due to its high energy content, palatability, and digestibility. However, its fluctuating price and availability, particularly in tropical and subtropical regions, necessitate the exploration of alternative feedstuffs. Cassava (Manihot esculenta Crantz) grits, derived from the root of the cassava plant, present a viable alternative, offering a high energy yield but posing unique nutritional challenges. Understanding the individual and combined effects of these two ingredients is crucial for optimizing broiler performance and ensuring economic viability in poultry farming (Poultry Nutrition Handbook, 2019).

After seven weeks it was observed that the total mean feed intake was 3.514kg, 3.690kg and 3.820kg respectively and the average feed intake significantly increased by bird ($p<0.001$). Treatments barely affected the feed intake per bird ($p<0.1$). Birds on treatment C tend to consumed more feed than those on treatment B and C. The feed consumption rate on group B is greater than feed intake of birds on treatment A, this is confirmed by LSD imposed. (Table 1 and figure 1)

The weight gain 0n the 7th week was 1.40kg, 1.50kg and 1,80 kg for birds in group A, B and C respectively. It was revealed that birds in group C had more weight gain than the other two groups A and B. (Table 2 and figure 2)

The result further shows that treatment differences are barely significant ($p<0.1$). Increase in number of weeks significantly increased water intake ($p<0.001$). A reflection of the increased feed intake with increased number of weeks was evident. The total mean water intake after week 7 was 8.681 liters, 9.091 liters and 10.339 liters respectively. It was observed that birds in group C consumed more water than the rest of the groups. This is revealed by the line graph. (Table3 and Figure 3)

The relative price per 50kg of the compounded feed were NLe603, Nle183.82, and NLe 158.34 for treatments A, B, and C respectively (Appendix).

These prices were predominantly due to the inclusion rate of the concentrate particularly in treatment A where the inclusion rate of the concentrate was 35%... This was also the case for treatment B where the inclusion of concentrate was 30%. Treatment C had the lowest inclusion rate of concentrate and therefore the price per 50kg was lowest. Therefore, the limiting factor in the preparation of feed for poultry and swine are concentrates. These are imported feed which cost is exorbitant.

**5.3. CONCLUSION**

The formulation of basal feeds is a complex process that requires careful consideration of various nutrient components—energy sources for caloric needs; protein sources for tissue development; vitamins for metabolic functions; and minerals for structural integrity among others. A well-balanced basal feed with good management practices not only supports optimal growth but also enhances productivity while ensuring the overall well-being of livestock.

With regards, weights and water intake, the cassava containing diets (A and B) were much inferior compared with maize. This was clearly proven by the linear regression imposed with regards weights. The A and B rations though inferior were not significantly different from the result obtained from C. In fact, in the earlier ages of the birds there was no marked differences between all the three treatments. The differences between C and others became pronounced only after 4 weeks and increasingly so afterwards. . With regards the feed cost ration A was the most expensive but less superior. Ration C was the least expensive but the most superior. However, the high cost of maize may be escalated by substantial losses during storage; also availability of this product may be strictly seasonal thus nullifying the benefit. Or economic returns.in the use of maize. Cassava on the other hand is not as expensive as maize and its availability is not strictly seasonal. Also, its storage may not pose problem as cited earlier, the only problem is the processing. If it should be used on a large scale requires the handling of bulk dehydrators hence cost may be substantial for any economic returns.

**5.4. Recommendations**

1. Thorough Detoxification:

Always ensure cassava roots are adequately processed (e.g., grating, pressing, and prolonged drying, or fermentation) to reduce cyanogenic glycoside levels to safe limits (below 50 ppm HCN equivalent in the final feed) (Tropical Feeds and Feeding). Inadequate processing is the primary reason for poor performance when using cassava.

Quality Control: Implement strict quality control measures for purchased cassava grits, including moisture content and residual HCN analysis, to ensure consistency and safety.

2. Diet Formulation and Supplementation

Energy and Protein Balance: When replacing maize with cassava grits, adjust the diet to compensate for cassava's lower protein and amino acid content. Supplementation with high-quality protein sources (e.g., soybean meal, fish meal) and synthetic amino acids (lysine, methionine, threonine) is essential (Poultry Nutrition Handbook).

3. To reduce feed cost, local protein sources must be exploited.

This could be done by using combination of vegetable proteins like groundnut cake, and sesame seed cake, peas of beans.

Optimal Inclusion Levels:

4. For partial replacement, start with moderate levels (e.g., 10-30% of the diet) and gradually increase based on performance and economic viability. Higher inclusion levels (up to 50% or more) are possible but require more precise nutritional balancing and careful management (Animal Feed Science and Technology).

5. Enzyme Supplementation: Consider adding exogenous enzymes, particularly amylases, to improve starch digestibility and nutrient utilization from both maize and cassava, potentially enhancing FCR (Feed Ingredients for Poultry Production).

Vitamin and Mineral Fortification: Ensure adequate vitamin and mineral supplementation, as cassava offers minimal contributions to these micronutrients.

6. Monitoring and Management

Performance Monitoring: Regularly monitor broiler performance parameters (body weight gain, feed intake, feed conversion ratio) to assess the efficacy of the diet. Any significant drop in performance may indicate issues with cassava quality or diet formulation.

6. Palatability and Dustiness: Cassava grits can sometimes be dusty, which might affect feed intake. Pelleting the feed can mitigate dustiness and improve palatability and nutrient utilization (Poultry Production and Management).

7. Economic Analysis: Continuously evaluate the cost-effectiveness of using cassava grits versus maize, considering market prices, processing costs, and the need for additional supplements. The goal is to reduce feed costs without sacrificing broiler performance

8. By combining cassava and maize, nutritionists can formulate diets that are economically viable without compromising performance. The high starch content of cassava complements the energy contribution of maize, allowing for flexibility in diet formulation.

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