EFFECTS OF REPLACING MAIZE WITH RICE BRAN ON THE GROWTH PERFORMANCE OF BROILER CHICKS FOR SUSTAINABLE FOOD SECURITY

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Abstract
A feeding trial was conducted to determine the effects of replacing maize with rice bran on the growth performance of broiler chicks for sustainable food security. Three specific purposes and three research questions guided the study. The experiment was carried out in the Department of Agricultural Education Poultry Unit, UNN. A Completely Randomized Design (CPD) was adopted, and a total of 124-day-old chicks from Royal Hatchery Farms, Ibadan were studied. The chicks were reared together for a period of one week, and thereafter, the 120 chicks that survived after one-week adaption were distributed into four treatment groups- T1, T2, T3 and T4 through a simple random selection, each group had 30 birds with three replicates of 10 birds each. Four different diets containing varying levels of inclusion of rice bran were formulated. The birds in T2, T3 and T4 were supplemented with scent leaf extract via the drinking water, while the birds in Tl (control group) were given oxytetracycline antibiotic. Data on daily feed intake and weekly weight gain were collected using weighing scale, while data on feed conversion ratio was computed. Data collected were analyzed using mean. The results from the study showed that Treatment 3- the group fed 5% rice bran and 10ml scent leaf extract performed best in terms of feed conversion ratio, weekly body weight gain and average body weight. T3 had 1.82 and 1.90 feed conversion ratio for week 2 and week 4, while T2 got the best feed conversion ratio of 1.89 for week 3. For feed intake, the result showed that Tl recorded the highest average weekly feed intake of 290.99g at week 2; while T3 recorded highest mean weekly feed intake of 576.15g at week 3; whereas in week 4, T2 obtained the greatest mean weekly feed intake of 875.11 g. The result further revealed that T3 had the highest average weekly body weight gain of 105.90g, 355,12g and 327.77g for weeks 2, 3, and 4 respectively The findings further revealed that Treatment 4 had the highest mean body weight of 1300.12g at the end of week 4 closely followed by Treatment 2 had mean body weight of 1250.77g whereas T4 obtained the lowest mean body weight of 1050.7lg. Based on the findings, the study concluded that inclusion of 5% rice bran for partial replacement of maize, supplemented with 10ml scent leaf extract would enhance the performance of broiler chicks
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Keywords: Broiler birds, Growth Performance, Rice Bran, Scent Leaf extract.

Introduction

Broiler birds (*Gallus gallus)* originated from the red jungle fowl of Southeast Asia (Andersson, 2014). Broilers are young chicken of either male or female that developed from a hatch weight of between 38-40g to a weight of about 1.7kg within a period of six weeks which are reared for its meat production (Department of Animal Husbandry, Livestock, Fisheries and Veterinary Services, 2013). Broilers can also be regarded as chicken birds reared by man mainly for food (meat) and income generation which mature within a period of 6 weeks. The broiler starters chicks on the other hand are broiler chicks of either sex (male or female) reared for a period of 3 or 4 weeks. The broiler starter chicks are eithersold off after brooding period of 3 or 4 weeks (brood and sell) or taken to grower' s/finishers pen where they will for another 3 or 4 weeks into adult broiler chicken. Broiler meat is a potential source of protein to human diet, Okey and Egede (2021) maintained that broiler meat is cherished by most people in Nigeria because of its sweet taste, tenderness and nutritive value. Prabakaran (2013) stated that the meat of broiler contains 150 calories per 100g, has lesser cholesterol than some foods of animal origin, and the meat's fibre is very tender which makes it easy to chew, grind and digest. The nutritive value of broiler meat and the short period of maturity likely makes a lot of people to engage in broiler farming.

One major problem facing broiler birds' production particularly in Nigeria is high cost of feeds and feed ingredients especially maize, sorghum, and fishmeal. Okosun and Eguaoje (2017) opined that the energy feed sources such as maize, sorghum and millet are the most expensive feedstuff of poultry feeds which constitute about 50 55 % of every formulated diet. Feed ingredient like maize has high energy contents and can be included in broiler feeds at high levels without problems (Alhotan, 2016). Maize production has decreased recently due to the insurgency in the north-eastern part of Nigeria and the recent maize worm devastation recorded in some Southern States of Nigeria which has further increased the demand-supply gap in the energy feed resource (Okosun & Eguaoje, 2017). The above scenario reduces maize availability and raises the price due to increased competition between man, industry and livestock (Onabanjo, et al, 2021). Fishmeal on the other which is major protein source is very costly and scarce. There is need to source for potential alternative feed ingredients. For improvement and sustainable growth in poultry production, the need to source for alternative feed materials that are safe, cheap, available and not in competition with other demands (Olusiyi, et al, 2019). A non-conventional feed ingredient which can be used as alternative to conventional feed ingredients like maize is rice bran (Zahir, 2020).

Rice bran is obtained from removing the outer layer of the rice kernel during milling processes (Bodie, et al, 2019). The rice bran constitutes some problems if not properly handled and completely removed (Njoku, et al, 2017). It is usually disposed to the land very close to the milling centre, which causes environmental nuisance. Nutritionally, rice bran has approximately 5-8% of the whole rice kernel and is considered nutritionally rich because it is composed of 15-22% lipids, 34-52% carbohydrates, 7-11% fibre, 610% ash, 8-12% moisture and IO- 16% protein (Luh in Bodie et al., 2019). Rice bran contains high dietary fibre which helps in maintaining a healthy weight and prevent overeating by providing a feeling of fullness during consumption of feed (GUI, Yousuf, Singh, Singh & Wan, 2015). Diets that are rich in fibre according to Bodie et al. (2019) have shown to lower cholesterol and blood pressure in humans. The authors further stated that the oil content of rice bran helps in binding animal feed together, thereby reducing feeds wastage. Based on these nutritional properties, rice bran can be considered as partial replacement of maize in formulating broiler feeds. Also, another important replacement is the use of scent leaf extract as a replacement to synthetic antibiotics.

Scent leaf, botanically called *Qcimum gratissimum* is an herbaceous perennial plant (Aikpitanyi, et al, 2017), that belongs to the Family *Labiatae* and genus *Ocimum* which are widely grown in the tropics of Africa and Asia (Alexander, 2016). It is a very vital herbal leaf whose benefits can be harnessed in poultry nutrition (Okey & Egede, 2021; Nte, OleforuhOkoleh and Fakae, 2017), The phytochemical constituents of scent leaf are peptides, alkaloids, essential oils, phenols and flavanols (Essari and Sour in Ndubuisi-Ogbonna et al, 2016). The phytochemical properties of the leaves of *Ocimum gratissimum* according to Alexander (2016) showed that the scent leaf contains some major bioactive compounds that are capable of inhibiting the growth of microorganism. This proves that scent leaf is an effective potential source of antibiotic. The plant is commonly used because of their bioactive properties in fighting bacterial diseases, anti-inflammatory and immune modulatory agents (Ubua, et al, 2019). Due to the medicinal and nutritional properties of scent leaf, it can be used as natural antibiotic thereby serving as replacement to synthetic antibiotics in broiler farming for efficient feed utilization, decreased mortality rate and improved growth performance.

Growth is a characteristic feature of living things. According to Fuller in Bassey (2019), growth is a gradual and dynamic process by which animals change from a single newly fertilized cell into an adult. Idodo (2010) defined growth as irreversible increase in size, parts, length and weight of an organism. The author also noted that, growth takes place when food and water are taken in by living organism whether plants or animals. Moyle (2015) stated that the growing periods of broiler chick starters begins from the time the chicks are hatched to the end of brooding stage usually a period of 3 or 4 weeks. The growth performance of broiler chick starters is highly dependent on certain factors which are the genetic make-up, feed and water, environmental factors and the management practices adopted by the farmer. Broiler chick starters generally require feed rich in protein, fat, carbohydrates, vitamins and minerals for optimal growth performance (Ministry of Foreign Affairs, 2020). Although, getting such feeds that are rich in the essential nutrients are very costly nowadays.

High cost of feeds and feed ingredients pose serious challenge to livestock farmers especially poultry production. Olusiyi, Yusuf, Zaklag and Dilala (2019) opined that the main problem confronting livestock

producers in Nigeria today especially poultry farming is the unavailability and high cost of the conventional feed ingredients which have resulted to increase in the cost of production. The poultry farmers and other livestock farmers appear most hit in terms of high cost of feed due to exorbitant cost of feed ingredients (Okosun & Eguaoje, 2017). The feed costs of broiler birds' production are very significant as they constitute almost three fourths of the total cost of production (Ózsvåri, et al, 2017). However, since the high cost of conventional feed ingredients such as maize and fishmeal are very high, there is need to seek potential alternatives feed ingredients which are locally available, cheap and safe to both human beings and the birds. Therefore, the study determined the effects of replacing maize with rice bran on the growth performance of broiler chicks for sustainable food security.

Purposes of the Study

The general purpose of the study was to determine the effects of replacing maize with rice bran on the growth performance of broiler chicks for sustainable food security. Specifically, the study determined the effects of:

1. replacing maize with rice bran at 0%, 2.5%, 5%, 7.5% supplemented with 0ml, 5ml, 10ml, 15ml scent leaf extract on the daily feed intake of broiler chicks;
2. replacing maize with rice bran at 0%, 2.5%, 5%, 7.5% supplemented with 0ml, 5ml, 10ml, 15ml scent leaf extract on the feed conversion ratio of broiler chicks; and
3. replacing maize with rice bran at 0%, 2.5%, 5%, 7.5% supplemented with 0ml, 5ml, 10ml, 15ml scent leaf extract on the weekly weight gain of broiler chicks.

Research Questions

The following research questions guided the study:

1. What are the effects of replacing maize with rice bran at 0%, 2.5%, 5%, 7.5% supplemented with 0ml, 5ml, 10ml, 15ml scent leaf extract on the daily feed intake of broiler chicks?
   What are the effects of replacing maize with rice bran at 0%, 2.5%, 5%, 7.5% supplemented with 0ml, 5ml, 10ml, 15ml scent leaf extract on the feed conversion ratio of broiler chicks?
2. What are the effects of replacing maize with rice bran at 0%, 2.5%, 5%, 7.5% supplemented with 0ml, 5ml, 10ml, 15ml scent leaf extract on the weekly weight gain of broiler chicks?

Materials and Methods

The study adopted experimental research based on a Completely Randomized Design (CRD). The experiment was carried out in Agricultural Education Poultry farm, University of Nigeria, Nsukka. The area is properly built and equipped for poultry rearing. A total of 120 day-old chicks were studied. The chicks were purchased from Royal Hatchery Farm located in Ibadan, Nigeria through a day-old chick distributor in Nsukka. There was no sampling because the entire birds were manageable and studied. The chicks were distributed equally into four treatment groups and each treatment had three replicates of 10 birds, making it a total of 30 chicks in each treatment. The instrument used for data collection were sensitive weighing scale, weighing scale and templates developed by the researcher. Data on daily feed intake and weekly body weight gain of broiler chicks were collected with sensitive weighing scale; while data on feed conversion ratio were computed. The templates were used to record the data collected. The templates developed for data collection were face-validated by three experts in the Department of Agricultural Education University of Nigeria, Nsukka. Data collection was done by the researcher and three assistants. The data collected were average daily feed intake, average weekly weight gain, and feed conversion ratio. Data on average daily feed intake were collected on a daily basis; data on average weekly weight gain was taken at the end of every week while the data on feed conversion ratio were computed using formula. The data collection specifically followed an experimental procedure.

Experimental Procedure

A total of 124 day-old chicks were purchased from Royal Hatchery Farm located in Ibadan, Nigeria. On arrival, the chicks were stocked immediately in the brooding pen. The chicks were reared together for a period of one week to enable them adapt to the new environment. Within this period, equal treatment was given to the chicks. After the adaptation period of one week, 4 mortalities were recorded, while the remaining 120 birds were carefully selected through a simple random and placed in four different experimental groups. Each treatment group received a total of 30 birds and 10 birds per replicate. The groups were:

Treatment (T1): Control Group = 0% rice bran replacing maize

Treatment (T2): = 2.5% rice bran replacing maize

Treatment (T3): = 5% rice bran replacing maize

Treatment (T4): = 7.5% rice bran replacing maize

Three different broiler starter feeds were formulated for Tl, T2, T3 and T3 with 24% crude protein. The feed for control group (T l) had no rice bran inclusion while the feeds for T2, T3 and T4 had 2.5%, 5% and 7.5% rice bran replacement with maize respectively. Also, the control group had 0.10% oxytetracycline antibiotic added in their drinking water, while T2, T3 and T4 had 5ml, l0ml and 15ml scent leaf extract added in their drinking water respectively.

The scent was purchased in Ikpa Market in Nsukka. The scent leaf was properly washed with clean running Water without squeezing in order to remove all forms of dirt. After washing, the leaves will be air-dried at room temperature for two weeks until they become brittle. After which, the dried leaves will be milled with a hammer mill and sieved through a 2mm screen, before storing it in an air-tight plastic container. To prepare the infusion, fifty (50) grams of milled leaves was infused in I litre of hot boiled water for 12 hours (overnight). All through the brooding stage apart from adaption period of one week, data on daily feed intake and weekly body weight gain were collected. The experiment lasted for a period of 3 weeks. All the data collected were analyzed using mean, and standard deviation, Mean was used to answer the research questions.

RESULTS

Research Question 1: What are the effects of replacing maize with rice bran at 0%, 2.5%, 5%, 7.5% supplemented with 0ml, 5ml, I0ml, 15ml scent leaf extract on the daily feed intake of broiler chick?

Table 1: Mean Daily Feed Intake (g) of Broiler Chicks Fed with Rice Bran at 0%, 2.5%, 5%, 7.5% Supplemented with 0ml, 5ml, 10ml and 15ml Scent Leaf Extract

Age of Chicks	N	T1 (g)	T2 (g)	T3 (g)	T4 (g)
Week 2	30	290.99	273.06	289.07	280.02
Week 3	30	560.00	567.85	576.15	523.90
Week 4	30	723.80	875.11	805.00	780.95

Note: 1st week was used for adaptation; no data was collected

Table I showed that there were differences in the mean weekly feed intake among the four groups. Tl which was the control group had the highest mean weekly feed intake of 290.99g at week 2, sequentially followed by T3, T4, and T2 with mean weekly feed intakes of 298.07g, 280.02g, and 273.06g respectively. In week 3, T3 recorded the highest weekly feed intake of 576.15g, followed by T2 (567.85g), Tl (560.00g) while T3 had the least weekly feed intake of 523.90g. At week 4 which was the last week of the experiment, T2 obtained the highest mean weekly feed intake of 875.1 lg, followed by T3, T4 and Tl with mean weekly feed intake of 805.00g, 780.95g, and 723.80g respectively.

Research Question 2: What are the effects of replacing maize with rice bran at 0%, 2.5%, 5%, 7.5% supplemented with 0ml, 5ml, 10ml, 15ml scent leaf extract on the feed conversion ratio of broiler chick?

Table 2: Mean Feed Conversion Ratio of Broiler Chick Fed with Rice Bran at 0%, 2.5%, 5%, 7.5% Supplemented with 0ml, 5ml, 10ml and 15ml Scent Leaf Extract

Age of Chicks	N	T1	T2	T3	T4
Week 2	30	2.26	2.00	1.82	2.02
Week 3	30	2.23	1.89	1.93	2.24
Week 4	30	1.93	1.99	1.90	2.00

The data in Table 2 revealed that T3 had the best average feed conversion ratio (FCR) of I .82 at week 2 while the control ground (Tl) had highest feed conversion ratio of 2.26. At week 3, T2 recorded the least feed conversion ratio of I .89 followed by T3 with feed conversion ratio of 1.93 whereas the highest feed conversion ratio was found in T4 (2.24). At week 4, T3 had the least FCR of I .90 while T4 had the highest feed conversion ratio of 2.00.

Research Question 3: What are the effects of replacing maize with rice bran at 0%, 2.5%, 5%, 7.5% supplemented with 0ml, 5ml, 10ml, 15ml scent leaf extract on the weekly weight gain of broiler chick?

Table 3: Mean Weekly Weight Gain of Broiler Chicks Fed with Rice Bran at 0%, 2.5%, 5%, 7.5% supplemented with 0ml, 5ml, 10ml and 15ml Scent Leaf Extract

Age of Chicks	N	T1 (g)	T2 (g)	T3 (g)	T4 (g)
Week 2	30	90.90	95.22	105.90	100.90
Week 3	30	236.46	292.42	355.12	273.96
Week 4	30	227.37	321.07	327.77	235.60

Table 3 indicated that there were differences in the mean weekly weight gains of broiler chicks feed rice bran and scent leaf extract and those fed conversion feed, At week 2, T3 had the highest average weekly body weight gain of 105.90g, followed by T4, T2 and Tl with average body weekly weight gain of 100.90g, 95.22g, and 90.90g respectively. At week 3, T3 also recorded the highest weekly body weight gain of 355.12g while Tl obtained the smallest weekly body weight gain of 236.46g. At week 4, Treatment 3 got the greatest mean weekly body weight gain of 327.77g, followed by Treatment 2, Treatment 4 and the control group (Tl) with average weekly body weight gain of 321.07, 235.60 and 227.37 respectively.

Table 4: Mean Body Weight of Broiler Chicks After Week 4 Fed with Rice Bran at 0%, 2.5%, 5%, 7.5% Supplemented with 0ml, 5ml, 10ml and 15ml Scent Leaf Extract

Treatments	Average Body Weight (g) at the end of 4th week
T1	1150.03
T2	1250.09
T3	1300.12
T4	1050.77

The data in Table 4 revealed the average body weights of broiler chicks at the end of week 4 in different treatment groups. Treatment 3 had the highest average body weight of 1300g, followed by T2 (1250g) and Tl (1150g), while T4 had the lowest average body weight gain at the end of the 4th week.

Discussion

The results in Table 1,2,3, and 4 revealed that the inclusion of rice bran at 0%, 2.5%, 5% and 7.5% for partial replacement of maize and supplement with scent leaf extract at 0ml, 5ml, 10ml and 15ml could lead to improved growth performance of broiler chicks. The result showed that Treatment 3- the group of birds fed 5% rice bran and 10ml scent leaf extract performed best in terms of feed conversion ratio, average weekly body weight gain, and average body weight. T3 had 1.82 and 1.90 feed conversion ratio for week 2 and week 4 while T2 got the best feed conversion ratio of 1.90 for week 3. For feed intake, the result showed that T1 (control group) recorded the highest average weekly feed intake of 290.99g at week 2; while T3 recorded the highest average mean feed intake of 576.15kg at week 3; whereas in week 4, T2 obtained the greatest mean feed intake of 875.11g. The result further revealed that T3 recorded the highest average weekly body weight gain of 105.90g, 355.12g and 327.77g for weeks 2,3, and 4 respectively. The findings further revealed that Treatment 3 had the highest mean body weight of 1300.12g at the end of week 4 closely followed by Treatment 2 with mean body weight of 1250.77g whereas T4 recorded the least mean body weight of 1050.77g.

The effects of rice bran on the daily feed intake, FCR, and body weight gain observed in the present study were consistent with Onabanjo, et al (2020) findings. The authors found out that the growth performance of broiler chicks fed rice bran at inclusion levels of 5% to 10% had greater average weekly weight gain and improved feed conversion ratio than the chicks that were fed without rice bran and those that were fed rice bran above 10% inclusion. According to Bodie, et al (2019), rice bran can be supplied at a low level in the feed of broiler chicks, which serves as a potential nutritional supplement to chicks. Rice bran contains high dietary fibre which helps in maintaining a healthy weight and prevent overeating by providing a feeling of fullness during consumption of feed (Gul et al, (2015). Diets that are rich in fibre according to Bodie et al (2019) have shown to have lower cholesterol and blood pressure in humans.

Also, the findings were in consistent with findings of Okey and Egede (2021). The authors found out that the inclusion of leaf extracts of scent

leaf in the water of broiler chicks improved the body weight gain of broiler chicks and it was tolerable, acceptable and favourable to poultry. The authors further observed that scent leaf extracts improved the water intake and blood parameters of the broiler chicks. In a similar report, Obasi (2020) noted that the weight gains of the broiler chicks fed scent leaf extract were higher than the weight gain of chicks fed without any extract. The improved weight gain recorded in the chicks fed scent leaf extract could be as a result of the nutritional and medicinal properties of inherit in scent leaf Alexander (2016) showed that the scent leaf contains some major bioactive compounds that are capable of inhibiting the growth of microorganism. This proves that scent leaf is an effective potential source of antibiotic. The plant is commonly used because of their bioactive properties in fighting bacterial diseases, anti-inflammatory and immune modulatory agents (Ubua, et al, 2019).

Conclusion

Based on the findings obtained from this study, replacement of maize with rice bran at 5% supplemented with 10ml scent leaf extract can improve feed utilization, feed conversion ratio and weight gain of broiler chicks. Therefore, the inclusion of 5% rice bran for partial replacement of maize the supplementation of scent leaf extract at 10ml per litre of drinking water is ideal for broiler starter ration.

Recommendations

Based on the findings, the following recommendations were made:

1. Broiler farmers should replace maize with rice bran at 5%, supplemented with 10ml scent leaf extract to broiler starter ration in order to improve feed utilization, feed conversion ratio and body weight gain of broiler chicks.
2. Poultry feed manufacturers can also improve the quality of broiler feed starter by replacing maize with rice bran at 5% inclusion. This will help in reducing the cost of broiler feed.

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