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Potentials of rice husk as energy supplement in poultry broiler production

Abstract

Energy is a fundamental recipe for all life forms. All living things including poultry require energy for cellular activity, growth and reproduction. Energy is basically derived from food nutrient sources such as carbohydrates, excess proteins, fat and oil both of plant and animal sources. The cost of raising poultry has continue to increase due to increasing cost of feedstuff and the poor genetic make-up of birds which confers some breeds with very feed conversion efficiency. A total number of 20day old chicks were used to investigate the effects of inclusion of rice husk as Dietary Supplement in a formulated finisher feed, on growth performance characteristics. Four different levels (0%, 0.6%, 1.0%, and 1.4%) of formulated feed with rice husk as dietary supplement were evaluated in the experiment. Daily feed intake, feed conversion ratio, body weight gain and mortality rate were assessed in all the treatment groups evaluated. The results showed that mean body weight and feed conversion after 8 weeks for diets did not differ significantly ($p<0.05$). Results of analysis of the four different levels of concentration of rice husk, the control (0%) had the highest body weight followed by 1.4%, then 1.0% and 0.6% after the experiment respectively. In respect to the feed intake, it was observed that treatments with the highest concentration or level of rice husk (1.4%), had the highest feed intake amongst other treatments. This research work showed that rice husk could economically replace other energy sources to a certain extent in the broiler ration. Thus, the inclusion of fibre (rice husk) in feed dilutes energy concentration in the plant fibre and making same available to the poultry for increased growth.

Keywords: nutrient substitution, feed intake, weight gain, feed conversion efficiency, rice husk.

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Introduction

There are more emphasis now than ever placed on global food security. Poultry meat offers considerable potentials for bridging the gap between supply and demand for animal protein especially in Africa and other less developed nations of the world. The low level or rate of supply of animal protein has been attributed to the poor performance of livestock.[1] which has been attributed to factors such as inadequate nutrition, high price and poor quality of feeds, and inefficiency in the production and poor distribution network in the feed industry.[2]

It is worthy to note that several attempts have been made in this region to reduce feed cost while improving productivity of high meat yielding exotic poultry like broiler chickens. The attempts include the use of agro-industrial by-products,[1] maggot meal,[3] leafy vegetable protein concentrate.[4] Apart from the inadequate supply and the huge demand for animal protein, there has been a resurgence of interest in improving the physio-chemical and sensory properties of meat as well as its storage life.

The positive effect of herbal feed supplements on broiler performance, carcass quality and quality traits of meat have been demonstrated by experts.[5] Furthermore, the stiff competition existing between humans and animals over the limited supply of grains has resulted in a near collapse of the poultry industry in Nigeria.[6] There is, thus an urgent need to shift out attention toward exploitation of other tropical sources. One such potential source that is not realized to its fullest extent "Rice Husk".

Rice husk is a by-product of rice milling. During milling of paddy about 78% of weight is received as rice, broken rice and bran, the rest 22% of paddy is received as husk. According to Abgede *et al*, 2002 rice husk contains 25% cellulose, 30% lignin, 15% pentosan and 21% ash. After the husk is removed the remaining product is called brown rice including bran, germ and endosperm. The commercial milling of rice produces fractions such as husk and brans. These by-products are often considered less important and of low value. Thus, are usually disposed indiscriminately which causes environmental nuisance.

Rice is a major food grain in Nigeria, and also for the people of at least fifteen other countries in the world. In Nigeria, rice is one of the important food crops that has attained a staple food status and also become a major source of calories for the urban poor.[7] Furthermore, it has been emphasized that rice is not only a key source of food, but also a major employer of labour and source of income for the poor. In rice producing areas, the enterprise provides employment for more than 80% of the inhabitants in various activities along the production/distribution chain from cultivation to consumption.[8] Production of rice paddy is associated with the production of essentially two byproducts, rice husk and rice bran. Husk, also called hulls, consists of the outer shell covering the rice kernel. As generally used, the term rice husk refers to the byproduct produced in the milling of paddy and forms 16-25% by weight of the paddy processed. In the majority of rice producing countries much of the husk produced from the processing of rice is either burnt for heat or dumped as a waste.

Nigeria alone produces around 4.3 million tons of rice paddy per year, giving around 1.1 million tons of rice husk per year. Farm income can be increased both directly and indirectly if economically profitable means of utilizing rice husk generated are utilized in industry. There are many reported uses of rice husk such as a fuel in brick kilns, in furnaces, in rice mills for parboiling process, in the raw material for the production of xylitol, ethanol, acetic acid, lignosulfonic acids, as a cleaning or polishing agent in metal and machine industry and in the manufacturing of building materials.[9] Despite having so many well-established uses of rice husk, little portion of rice husk produced

is utilized in a meaningful way, remaining part is destroyed by burning or allowed to decay in public places in the open air creating environmental pollution. Farmers are getting very less prices for their paddy harvested. From paddy rice, the byproducts or residues are paddy straw, paddy husk and rice bran but only paddy straw is being utilized by farmers in Cross River State. At the time of the survey most of the husks generated in all the mills are disposed of, either by: depositing in the open land and for burning; depositing on the river banks which will eventually be washed away; using for mulching; using for bedding in poultry and pig sheds. Hence, the research is tailored to harness the energy potentials in rice husk as supplement in high-cost poultry feed.

Materials and methods

Experimental site:

The research was conducted at the Department of Genetics and Biotechnology Animal House University of Calabar, Calabar. The duration of the study/research was 8 weeks.

Experimental animals

A total number of 20-day old commercial broilers of Anak 2000 strain were procured for this research study.

Experimental materials

The rice milling waste (Husk) was purchased from a rice mill in Ofodua Area of Obubra Local Government Area in Cross River State. Other ingredient such as groundnut, soya beans, bone meal, wheat offal, lime, salt, maize germ, vitamin premix, starter mash, grower mash etc., were purchased from watt market in Calabar cross river state Nigeria. Vaccines was also purchased and included into the diet to avoid mortality resulting from disease infestation or attack.

Initial feeding

Twenty-day old (mixed sex) broilers of commercial strain was used for the experiment. The birds were housed in cage constructed in the animal house and light and ventilation was adequately provided. The twenty-day old broiler birds were fed with pure commercial feed and not the formulated feed for weeks 1 to 5. This is because rice husk contains a very high percentage of lignin, fibre and silica, which, cannot be easily broken down by day old broiler birds (Swaennen *et al.*,2010).

Feed formulation

The finishers mash was formulated using the following ingredients; rice husk, soya beans, groundnut, bone meal, crayfish dust, wheat, maize germ, vitamin premix, lime etc. The rice husk was included into the formulated feed as dietary supplement in varying compositions per treatment level.

Composition by kilogram weight of ingredients as used in finisher formulation

Ingredients	Control	6%	10%	14%
1. Maize	66.00	66.00	66.00	62.00
2. Soyabean	18.55	18.55	15.55	14.55
3. Groundnut cake	12.00	8.00	5.00	5.00
4. Rice husk	0.00	6.00	10.00	14.00
5. Bone meal	2.00	2.00	2.00	2.00
6. Oyster shell	0.50	0.50	0.50	0.50
7.Vitamin premix	0.25	0.25	0.25	0.25
8. Salt	0.50	0.50	0.50	0.50
9. Methionine	0.10	0.10	0.10	0.10
10. Lysine	0.10	0.10	0.10	0.10
Total	100 kg	100 kg	100 kg	100 kg

Feeding trial

After 1-5 weeks of feeding the birds with commercial feed, the birds were then divided into four groups containing five birds each.

Group 0ne (control): The birds in this group served as the control and were fed with pure commercial finishers feed.

Group two (treatment one/T1): The birds in this group were fed with formulated feed containing 6% of rice husk as dietary supplement.

Group Three (Treatment two/T2): The birds in this group were fed with formulated feed containing 10% of rice husk as dietary supplement.

Group Four (Treatment three/T3): The birds in this group were fed with formulated feed containing 14% of rice husk as dietary supplement.

Management procedure and data collection

On arrival the 20-day old chicks were first weighed and then housed together, and fed with pure commercial feed. At five weeks, the birds were then divided into four groups each containing five birds. The birds were then fed according to their treatment level. Meanwhile experimental birds received 12 hours natural day light, in the night the birds were supplied with light from electric bulb. Wood shavings were used as litter. The birds were vaccinated properly so as to avoid disease outbreak.

The following parameters were measured and recorded

Body weight (BW): This was done on a weekly basis. The birds were weighed and then their weight was then recorded.

Feed Intake (FI): This parameter was taken on daily basis. It was then by simply subtracting the left-over feed from the initial amount that was given.

Feed conversion ratio (FCR): This parameter was taken on weekly basis.

Mortality rate and the wellness condition of the birds under each dietary treatment level.

Experimental design and statistical analysis

The study involved a completely randomized design (CRD). Data obtained from this experiment was subjected to analysis of variance (ANOVA) and significantly different means were separated using the Fishers least significant difference (LSD) technique.

Results

The effects of four different concentration or levels of formulated feed with rice husk as dietary energy supplement on the body weight gain, feed intake, feed conversion ratio, and mortality rate, during the period of the experiment or research is presented in (Table 1–3).

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Table 1 Effect of rice husk on Age (Weeks), Mean Weekly Weight Gain (kg) Across the Various Groups

Treatment	Week 1	Week 2	Week 3
0%	2.21±0.11	2.40±0.06	2.86±0.21
0.60%	1.96±0.05	2.22±0.07	2.33±0.06
1.00%	2.01±0.10	2.32±0.05	2.45±0.07
1.40%	2.17±0.08	2.42±0.07	2.46±0.07

*Results are presented as mean±standard error
* Means with different superscript letters along each vertical array differ significantly (p>0.05)

Table 2 Effect of rice husk on Age (Weeks), Mean Weekly Feed Intake (kg) Across the Various Groups

Treatment	Week 1	Week 2	Week 3
0%	0.8459±0.06	1.004±0.072	1.154±0.082
0.60%	0.6242±0.044	0.8528±0.061	1.0925±0.078
1.00%	0.6971±0.050	0.8929±0.064	1.0171±0.083
1.40%	0.7918±0.057	0.9986±0.070	1.138±0.081

*Results are presented as mean±standard error
*Means with different superscript letters along each vertical array differ significantly (p>0.05)

Table 3 Effect of rice husk on Age (Weeks), Mean Weekly Feed Conversion ratio (FCR) across The Various Groups

Treatment	Week 1	Week 2	Week 3
0%	0.40±0.03	0.70±0.07	0.75±0.09
0.60%	0.03±0.06	0.07±0.01	0.52±0.14
1.00%	0.04±0.02	0.04±0.02	0.43±0.05
1.40%	0.31±0.04	0.50±0.14	0.61±0.15

*Results are presented as mean±standard error
* Means with different superscript letters along each vertical array differ significantly (p>0.05)

There was no significant differences (p>0.05) recorded in the body weight gain, feed conversion ratio and feed intake among the various groups. There was also no significant difference in mortality rate as there was no mortality at all.

However, analysis of variance (ANOVA) indicated that were no significant differences in all characteristics evaluated (p>0.05) at different weeks. Though there was a direct relationship between feed intake and weight gain. Analysis of variance (ANOVA) however indicated that mean weekly feed intake did not differ significantly (p>0.05) at different concentrations of the formulated feed containing rice husk as dietary supplements. In respect to the different levels of concentration in the formulated feed with rice husk as dietary supplement (0%, 0.6%, 1.0%, 1.4%), 0% had the highest weight gained followed by 1.4%, then 1.0% and 0.6% respectively.

Also, with respect to the different levels of concentration of the formulated feed containing rice husk as dietary supplement. (0%, 0.6%, 1.0%, 1.4%). 0% has the highest feed intake, followed by 1.4%, then 1.0% and 0.6% respectively. The trend showed that an increase in the concentration of rice husk led to an increase in feed intake which invariably led to an increase in weight gain. Neshiem et al (2009); Von Loesecke, (1990); Altlen and Hankein (2009) suggested that amino acids fortified vitamins could be used to counteract the anti-nutritional effect of lignin and silica and to improve the production efficiency. According to the analysis of variance (ANOVA) results, mortality rate was not significantly different (p>0.05) implying that there was no mortality.

Discussion

Rice Husk is a high fibre feed ingredient which affects feed intake and energy utilization in birds. The primary factor in the voluntary intake of chicks appears to be the need for energy. Birds will ordinarily eat to satisfy their energy requirement. As fibre content of the rick husk increases, density of the dust decreases. The inclusion of fibre (Rice Husk) in feed dilutes energy concentration of dust. Hence, for birds to keep a constant energy level they have to change their feed intake as the energy density of the feed changes, hence the need for increase feed intake.

Rice husk is a renewable energy resource which can be used to mitigate greenhouse gas (GHG) emissions. Conversion of rice husk into heat, steam, gas or liquid fuels would benefit countries that have no traditional energy resources and have an abundant supply of this agro-residue. Promoting the use of rice husk for the energy sector would mitigate local environmental problems, e.g., rice husk dumping and open burning, and highlight the benefits of GHG reduction to the community and environment.[10] In some countries, rice husk is partly used as an energy source for processes in the rice production, some other parts as an energy source for cooking, heating and other uses as well as soil ameliorator. It is estimated that worldwide 38 to 57 million tonnes of rice husk is available for energy generation. Due to its low density, transportation of rice husk is relatively expensive. It is therefore interesting to consider the option of generating heat and/or power on-site at rice mills where the husk is available and cost for transportation can be minimum.

A processing capacity of at least 100 tonne rice per day is considered to be essential to turn a rice mill into an interesting source of rice husk for the production of these energy forms.[11] At the end of this study which evaluated the effect of rice husk on the performance of finished broiler chickens, it was found that the rick husk provided substantial amount of energy for broilers and can be effectively harnessed for sustainable broiler production. The energy levels obtained when compared to other cereals or carbohydrate sources showed comparative advantage to other cereals. However, supplementation with cereals higher above 1.4% would lead to a decrease in the performance of broiler growth in the respective finishers.[12–43]

Conclusion

Among the four different levels of concentration of Rice husk, the control (0%) had the highest body weight followed by 1.4%, then 1.0% and 0.6% after the experiment respectively. In respect to the feed intake, it was observed that treatments with the highest concentration or level of Rice husk (1.4%), had the highest feed intake amongst other treatments. This may be due to the fact that rice husk is a high fibre feed ingredient, fibre affects feed intake and energy utilization in birds. The primary factor in the voluntary intake of chicks appears to be the need for energy. Birds will ordinarily eat to satisfy their energy requirement. As fibre content of the rick husk increases, density of the dust decreases. The inclusion of fibre (rice husk) in feed dilutes energy concentration of dust. Hence, for birds to keep a constant energy level they have to change their feed intake as the energy density of the feed changes, hence the need for increase feed intake.

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None.

Conflict of interest

The author has no conflict of interest to declare.

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