

CARCASS YIELD AND GUT CHARACTERISTICS OF BROILER CHICKENS FED DIETARY LEVELS OF RICE MILLING WASTE

By

*M. Yusuf¹; A. A. Liman¹; M. Antyev¹; A. Faruk¹; U. D. Doma²; K. M. Bello²; N. Adamu²; and F. Muhammed³*¹Department Animal Production, Taraba State College of Agriculture Jalingo, P.M.B 1025 Nigeria.²Department of Animal Production Abubakar Tafawa Balewa University Bauchi P.M.B 0248 Nigeria³Department Agricultural Technology Federal College of Horticulture Dadinkowa Gombe State, P.M.B 108 Nigeria**ABSTRACT:**

A feeding trial was conducted at the poultry research farm of the Abubakar Tafawa Balewa University Bauchi to evaluate the effect of dietary levels of Rice Milling Waste (RMW) on the carcass yield and gut characteristics of broiler chickens. RMW replaced wheat offal at 0, 25, 50, 75 and 100% levels designated as diets 1, 2, 3, 4 and 5 respectively. Two hundred and twenty broiler chickens were randomly allotted in to five dietary treatments with forty four chickens per treatment and replicated four times in a completely randomized design. Feed and water were supplied ad-libitum and the duration of trial lasted for eight weeks. All the carcass and gut characteristics measured were not influenced by the levels of RMW. It was concluded that RMW can completely (100%) replace wheat offal as dietary fibre source in the diet of broiler chickens with no adverse effects on carcass yield and gut characteristics of broiler chickens.

Key word: Carcass, Broiler chickens, Rice milling waste, ad-libitum

INTRODUCTION

Diets rich in structural fibre remain in the upper gastro-intestinal tract (GIT) long and might be digested more completely because of increased gastrointestinal refluxes (Sacranie, A. B., Svihus, V., Denstadli, B., Moen, P., Iji, V. and Chock, M., 2012). An increase in the dietary fibre increase the amount of gut fill causing a physical distension of the wall of the digestive tract and a contaminant increase in size and gut capacity (Jorgensen, H., Zhao, X. Q., Knudsen, K. E. B. and Eggum, B. D. (1996). The inclusion of antibiotics at low levels into the feed for extended period of time was a common practice in the poultry industry to control digestive disorders and proved to provide economic benefits to the broiler industry (Castanon, 2007).

Traditionally, dietary fibre has been considered an anti-nutritional factor and diluents in non-ruminant diets. Also many nutritionist have considered that the requirement of broiler for crude fibre (CF) are low and recommended to reduce its content in diet for broiler chicks to less than 3.0 - 4.0% depending on the age (Swennen, Q. S., Everaert, N., Debonne, M., Verbaeys, I., Carregghi, C., Tona, K., Janssens, G. P. J., Decuyper, E.,

Bruggeman V., Buyse, J. 2010). The inclusion of moderate amount of fibre in diets for broilers have positive effects on gizzard activity improving the mixing of the digesta and motility of the gastrointestinal tract (GIT) and also preventing the adhesion of certain pathogen bacterial population to the epithelial mucosa and growth performance of non-ruminant animals (Mateos G. G., Lazaro, R. and Gracia, M. I. 2002; Montagne, L., Pluske, J. R. and Hampson, D. J. 2003; Mateos, G. G., Jemenez-moreno, E., Serrano, M. P. and Lazaro, 2012). The presence of fibre in gizzard especially when highly insoluble and lignified coarsely ground fibre is used to stimulates organ development and functioning. In fact, the inclusion of dietary fibre consistently reduces pH in the gizzard and a reduction in digesta pH benefits pepsin activation and solubility of the mineral sources (Dunkley, 2007). The secretion of Hydrochloric Acid (HCl) and pepsinogen in the proventriculus will depend on the functionality of the gizzard; including the intensity of the contractions and retention time (Svihus, 2011). The increased grinding activity of the gizzard, together with a better mixing of digestive juice with the digesta in

addition to the increase in antiperistaltic movement within the GIT might explain the positive effects of insoluble dietary fibre on the digestibility of crude protein and other dietary component (Gonzalez-Alvarado, J. M., Jimenez-Moreno, E., Lazaro, R., Mateos G. G. 2007; Jimenez-Moreno, E., Gonzalez-Alvarado, J. M., Lazaro R., Mateos G. G. 2009). Soya beans pulp (SBP) is rich in pectins, a soluble fraction of dietary fibre that increases digesta viscosity, thus, SBP inclusion might hinder the diffusion and absorption of nutrient in the small intestine (Sarikhani, M., Shartyar, H. A., Gholizadeh, B., Hosseinzadeh, M. H., Beheshti, B., Mohmoodnejad, A. 2011). Chickens are one of the most common and widespread domestic animals and with a population of 19 billion in 2011 the domestication of chicken is stated in the encyclopedia as "Humans first domesticated chicken of Indian" origin (Garrigus 2007). Broilers were mostly young male chickens culled from farm flocks (Hardiman 2007). The chicks when they are produced will therefore, be hybrids or crosses since the birds are bred mainly for efficient meat production, producing eggs can be a challenge (Meijerhof 2011). Animal feeding dietary fibre is a concept difficult to define chemically and is therefore not easy to measure in feed (Lupton 2010). Consequently, the effect of dietary fibre on voluntary feed intake organ size gastro intestinal tract mortality, enzyme production, microbial growth and bird behaviour will differ depending on the source of fibre. In addition, the effect of dietary fibre on poultry physiology and productivity depend on the inclusion level and source of fibre (Story, 1976). Dietary fibre has an abrasive effect on the intestinal wall and may result in an increase in endogenous cell losses and nutrients to the lumen (Perez-Bonilla, A., Frikha, M., Miraie S., Garcia J., Mateos G. G. 2011). Rice Milling Waste can replace wheat offal up to 100% levels in broiler rations without any adverse effect on the carcass yield and gut characteristics.

MATERIALS AND METHODS

The study was conducted at poultry research farm of Abubakar Tafawa Balewa University, Bauchi, Bauchi State. The state occupies a land area of about 66,000 square kilometers. The state lies between longitude $10^{\circ}10'$ to $10^{\circ}33'N$ and latitudes $9^{\circ}40'$ to $10^{\circ}31'E$ at an altitude of 6902 meter above sea level. The study

area has two main seasons rainy season (June - October) and dry season (November - May). The total mean rainfall is 700 - 900mm for southern zone 690 - 1031mm for central zone and 900 - 1300mm for western zone (BSADP 2003). The temperature range from $19.15^{\circ}C$ to $28.5^{\circ}C$, the hottest months being March and April while the coldest months are January and February.

Management of the Experimental Birds

Two hundred and twenty (220) broiler chicks were purchased from Ibadan Oyo state. The chicks were brooded for seven days on deep litter using 200 watts of electricity bulb. Commercial broiler starter (hybrid grade feed) was fed to them during brooded period. After brooding the chicks were randomly assigned to five dietary treatments replicated four times each with eleven birds per replicate. Feed and water were supplied *ad libitum*. All vaccination schedules were administered to the birds at appropriate time so also anti stress was given to the birds on arrival and after every week of weighing.

Experimental Diets

Five experimental diets were formulated in which rice milling waste replaced conventional source of fibre i.e. wheat offal at 0, 25, 50, 75 and 100% levels which were designated as dietary treatment 1, 2, 3, 4 and 5 respectively. The diets were formulated to supply 2900 kcal/Kg ME, 23% and 20% crude protein for both starter and finisher phases respectively. Premix, bone meal, salt limestone methionine and lysine were also used in compounding of the feeds. The ingredients chemical composition and calculated analysis of the experimental diets for both starter and finisher phases as shown in Tables 1 and 2 respectively.

Experimental Design

The experimental design adopted was a Completely Randomized Design (CRD). The five diets

formed the treatments and each treatment was replicated four times.

DATA COLLECTION

Carcass measurements

At the end of experiment, forty birds (two from each of the four replicates in each treatment) were randomly selected and kept off feed for 12 hours. The selected birds were weighed early in the morning to obtain the slaughter weight and were eventually slaughtered by severing the jugular veins. They were plucked manually after immersing in warm water and weighed. The carcass was eviscerated and weighed to obtain the carcass weight after removal of the head and

legs. The dressing percentage was determined by dividing the carcass weight by live weight (slaughter weight) and multiplied by 100.

Organ measurements

Internal organs were dissected and measured in grams and the length of small intestine and large intestine were measured in centimeter. Individual organ was placed on an electric sensitive balance and the weight obtained was recorded. The lengths of the intestines were taken using plastic meter ruler. The weight of the various organs measured was expressed as a percentage of live weight.

Table 1: Ingredients and composition percentage of rice milling waste based diets fed to broilers at the starter phase (1 – 4 Weeks)

| Ingredients | Dietary Inclusion Levels | | | | |
|----------------------------|--------------------------|------------|------------|------------|------------|
| | 1(0%) | 2(25%) | 3(50%) | 4(75%) | 5(100%) |
| Maize | 47.13 | 46.30 | 45.47 | 44.63 | 41.80 |
| Soya Bean | 33.47 | 34.30 | 35.13 | 35.93 | 38.80 |
| Wheat Offal | 10 | 7.7 | 5.0 | 2.5 | 0.00 |
| RMW | 0 | 2.5 | 5.0 | 7.5 | 10.00 |
| FM | 5 | 5 | 5 | 5 | 5 |
| LMS | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 |
| Bone Meal | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |
| Salt | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Premix | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Lysine | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| Methionine | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| Total | 100 | 100 | 100 | 100 | 100 |
| Calculated Analysis | | | | | |
| Crude Protein % | 23.00 | 23.00 | 23.00 | 23.00 | 23.00 |
| ME (kcal/Kg) | 2922.57 | 2925.74 | 2923.4 | 2919.81 | 2912.28 |
| Crude Fibre % | 4.19 | 4.49 | 4.81 | 5.15 | 5.49 |
| Calcium % | 1.68 | 1.68 | 1.68 | 1.69 | 1.69 |
| Phosphorous % | 0.90 | 0.89 | 0.86 | 0.86 | 0.85 |
| Ether Extract % | 8.48 | 8.83 | 9.17 | 9.50 | 10.13 |

RMW: Rice Milling Waste LMS: Limestone ME Kcal/kg; Metabolisable Energy in Kilocal Per kg *each 2.5kg premix contains the following Vitamin A. 15,000iu, Vit. D₃ 3,000iu, Vit. E. 30,000iu, Vit. K 3000mg; Vit. B₁ 3,000mg; vit. B₂ 6,000mg; Vit B₆ 5,000mg; Vit. B₁₂ 40mg;

Biotin 200mg; Niacin 40,000mg; Pantothenic acid 15,000mg; Folic acid 2,000mg; Choline 30,000mg; Iron 60,000mg; Manganese 80,000mg; Copper 25,000mg; Zinc 80,000mg; Cobalt 150mg; Iodine 500mg; Selenium 310mg; Antioxidant 20,000mg.

Table 2: Ingredients and composition percentage of Rice Milling Waste Based Diets Fed to Broilers at the Finisher Phase (5 – 8 weeks)

| Ingredients | Dietary Levels of Inclusion | | | | |
|----------------------------|-----------------------------|------------|------------|------------|------------|
| | 1(0%) | 2(25%) | 3(50%) | 4(75%) | 5(100%) |
| Maize | 50.53 | 49.27 | 48.03 | 46.77 | 45.53 |
| Soya Bean | 28.07 | 29.33 | 30.57 | 31.83 | 33.07 |
| Wheat Offal | 15 | 11.25 | 7.5 | 3.75 | 0.00 |
| RMW | 0 | 3.75 | 7.5 | 11.25 | 15 |
| Fish Meal | 2 | 2 | 2 | 2 | 2 |
| LMS | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 |
| Bone Meal | 2 | 2 | 2 | 2 | 2 |
| Salt | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Premix | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Lysine | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| Methionine | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| Total | 100 | 100 | 100 | 100 | 100 |
| Calculated Analysis | | | | | |
| Crude Protein % | 20.00 | 20.00 | 20.00 | 20.00 | 20.00 |
| ME (kcal/Kg) | 2857.00 | 2853.00 | 2850.00 | 2846.00 | 2843.00 |
| Crude Fibre % | 4.27 | 4.74 | 5.21 | 5.67 | 6.14 |
| Calcium % | 1.49 | 1.49 | 1.49 | 1.49 | 1.49 |
| Phosphorous % | 0.85 | 0.83 | 0.81 | 0.78 | 0.76 |
| Ether Extract % | 7.69 | 8.20 | 9.71 | 9.23 | 9.74 |

RMW: Rice Milling Waste LMS: Limestone ME Kcal/kg; Metabolisable Energy in KiloCal Per kg *each 2.5kg premix contains the following Vitamin A. 15, 000iu, Vit. D₃ 3, 000iu, Vit. E. 30, 000iu, Vit. K 3000mg; Vit. B₁ 3,000mg; vit. B₂ 6,000mg; Vit B₆ 5,000mg; Vit. B₁₂ 40mg;

Biotin 200mg; Niacin 40,000mg; Pantothenic acid 15,000mg; Folic acid 2,000mg; Choline 30,000mg; Iron 60,000mg; Manganese 80,000mg; Copper 25,000mg; Zinc 80,000mg; Cobalt 150mg; Iodine 500mg; Selenium 310mg; Antioxidant 20,000mg.

RESULTS

The carcass yield and gut characteristics of broiler chickens fed rice milling waste based diets presented in Table 3 and 4. The live weight flucked weight, dressed weight and dressing percentage ranged from 1.96 to 2.16kg, in birds fed diets 2 and 1, 1.81 to 1.98kg in birds fed diets 4 and 1, 1.28 to 1.35kg in birds fed diets 4 and 1 and 62.24 to 67.09 in birds fed diets 1 and 3 respectively. The entire carcass yield measured was not influenced by the dietary levels of rice milling waste. Similarly, gizzard weight is however, tended to decrease with increasing levels of RMW in the diet. The following range of values were obtained for the various organs:

weight of the gizzard from (1.94 to 2.49%), the weight of the heart (0.44 to 0.57%), the weight of the liver (2.14 to 2.43%), the length of the small intestine (193.50 to 214.37cm), the length of large intestine (9.25 to 10.38cm), the weight of small intestine (6.37 to 6.99%), the weight of the large intestine (0.21 to 0.32%), the weight of the caeca (0.65 to 0.98%), the weight of the spleen (0.12 to 0.18%), the weight of the pancreas (0.26 to 0.33%), the weight of the lungs (0.55 to 0.63%), the weight of the head (2.54 to 3.03%) and the weight of the legs (4.35 to 5.11%). No significant dietary effect was obtained on the above weights measured.

Table 3: Carcass yield of broiler chickens fed dietary levels of rice milling waste

| Parameters | Diets | | | | | SEM |
|---------------------|-------|--------|--------|--------|---------|--------------------|
| | 1(0%) | 2(25%) | 3(50%) | 4(75%) | 5(100%) | |
| Liver weight (Kg) | 2.16 | 1.96 | 1.96 | 2.00 | 2.03 | 0.09 ^{NS} |
| Plucked weight (Kg) | 1.98 | 1.84 | 1.86 | 1.81 | 1.88 | 0.10 ^{NS} |
| Dressed weight (Kg) | 1.35 | 1.24 | 1.31 | 1.28 | 1.31 | 0.07 ^{NS} |
| Dressing % | 62.24 | 63.75 | 67.09 | 63.68 | 63.92 | 1.91 ^{NS} |

NS = Not Significant, * = Significant, SEM = Standard Error of Mean, SIW = Small intestine weight, LIW = Large intestine weight

Table 4: Gut characteristics of broiler chickens fed dietary levels of rice milling waste

| Parameters | Diets | | | | | SEM |
|----------------------|--------|--------|--------|--------|---------|---------------------|
| | 1(0%) | 2(25%) | 3(50%) | 4(75%) | 5(100%) | |
| Gizzard% | 1.94 | 2.49 | 2.41 | 2.32 | 2.09 | 0.22 ^{NS} |
| Head% | 0.44 | 0.57 | 0.48 | 0.46 | 0.42 | 0.04 ^{NS} |
| Liver% | 2.31 | 2.43 | 2.25 | 2.28 | 2.14 | 0.12 ^{NS} |
| Small Intestine (cm) | 202.75 | 214.37 | 194.50 | 206.75 | 193.50 | 14.14 ^{NS} |
| Large Intestine (cm) | 10.25 | 10.00 | 10.13 | 10.38 | 9.25 | 0.84 ^{NS} |
| SIW % | 6.76 | 6.96 | 6.91 | 6.37 | 6.99 | 0.45 ^{NS} |
| LIW % | 0.23 | 0.32 | 0.21 | 0.23 | 0.26 | 0.03 ^{NS} |
| Caeca % | 0.81 | 0.98 | 0.80 | 0.82 | 0.65 | 0.09 ^{NS} |
| Spleen % | 0.12 | 0.16 | 0.09 | 0.11 | 0.18 | 0.04 ^{NS} |
| Pancreas % | 0.29 | 0.33 | 0.33 | 0.31 | 0.26 | 0.03 ^{NS} |
| Lungs % | 0.55 | 0.62 | 0.63 | 0.53 | 0.58 | 0.04 ^{NS} |
| Head % | 2.78 | 2.89 | 3.03 | 2.79 | 2.54 | 0.18 ^{NS} |
| Legs % | 4.77 | 4.62 | 5.11 | 4.59 | 4.35 | 0.25 ^{NS} |

NS = Not Significant, * = Significant, SEM = Standard Error of Mean, SIW = Small intestine weight, LIW = Large intestine weight

DISCUSSION

The carcass yield revealed that live weight (1.96 to 2.16 kg) plucked weight (1.81 to 1.98 kg) dressed weight (1.28 to 1.35 kg) and dressing percentage (62.24 to 67.09%) were not influenced by the graded levels of rice milling waste in the diets. These observations were similar to the report of Gonzalez-Alvarado *et al.* (2007) who reported higher mean live weight and also higher dressed weight and dressing percentage with value of 61.25 – 68.81%. In respect of insoluble fibre such as that

contained in oat hulls reduces length of small intestine in broiler chickens.

The organs weights of gizzard (1.94 – 2.49%), heart (0.44 to 0.57%) and liver (2.14 to 2.43%) observed in this study did not differ. These findings tally with the report of Amaefule, K. J., Ibenkwumere F.C., Lawal S.A, and Ezekwonna A. A. (2006) who reported that the broiler chickens fed sorghum residue at 80% level to

replace maize had no effect on gizzard weight, gut length and live weight.

All the carcass and gut characteristics measured were not significantly affected by the levels of rice milling waste. This finding was contrary to the report of Yakubu, B., Adegbola, T. A., Bogoro S. and Yusuf H. B. (2007), in broiler chickens fed urea treated rice offal probably due to differences in the breed of chickens and type of rice milling waste used.

The mortality observed in this study was less than 5% indicating that rice milling waste was not

detrimental to broiler chickens as earlier observed by several researchers (Gonzalez-Alvarado *et al.*, 2007; Amaefule *et al.*, 2006).

CONCLUSION AND RECOMMENDATION

Rice milling waste has no adverse effect on carcass yield and gut characteristics. It is therefore recommended as a suitable alternative to wheat offal in broiler feeding.

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