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Effect of Different Levels of Rice (*Oryza sativa*) Bran on the growth Performance of Broiler Chicken

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ABSTRACT

Growth performance and feed utilisation of including different levels of rice bran (RB) in broiler chicken rations was evaluated. A total of 384 unsexed day old Cobb 500 broiler chicks with average body weight of 41.86±1.26 g were randomly divided into 24 groups each with 16 chicks. Finally six dietary treatments containing 0, 5, 10, 15, 20 and 25% of RB were randomly assigned to experimental chicks in a completely randomized design with 4 replicates both during the starters and finishing phases. The treatment rations were formulated based on the results of the laboratory chemical analytical data after chemical composition of samples of the major feed ingredients carried out. The experiment lasted for 56 days, during which feed intake and body weight changes were monitored. The amount of feed consumed determined as the difference between the feed offered and refused. Birds were weighed weekly in a group per pen. Body weight change was calculated as the difference between the final and initial BWs and the ADG was calculated as BW change divided by the number of experimental days. The FCR computed as the ratio of feed consumption and ADG. Mean daily feed consumption, growth performance, feed conversion ratio, rate of mortality, were used as the dietary treatment evaluation parameters. The results obtained indicated that the RB used in the current study contained 6.06, 14.09, and 2.6% of CP, CF, EE and ME of 2887 kcal/kg DM, respectively. There was no significant difference (P>0.05) between all the treatment groups in mean weekly feed consumption during5-8 and 0-8 weeks of the feeding trial. All the groups fed on the 0-20% of rice bran attained live body weight of 2.4-2.6 kg/head at the end of the 8th week without showing significant difference (P>0.05) between each other's during the 5-8 and 0-8 weeks of feeding in rate of growth. However, the group placed on the treatment containing 25% of rice bran attained significantly lower live body weight of about 2.3kg/head on the 8thweek of the feeding trial. Feed conversion ratio (FCR) of 2.26 was calculated for the groups fed on the treatment containing 10% rice bran during the starter's period, indicating this group produced at cheaper rate compared to the others. On the contrary, FCR of 2.59 was calculated for the groups fed on 25% of rice bran during the starter's period, the value of which was found to be expensive in production compared to the others. There was no significant difference between all the treatment groups in percent mortality. Depending on the production parameters measured, rice bran can be included at up to 15-20% in starter and finisher broilers diet without detrimental effects on carcass parameters, total serum cholesterol, total serum proteins and sensory test. Moreover, inclusion of up to 20% rice bran in broilers ration appeared to reduce 11% of production cost compared to the groups fed on control diet.

1. INRODUCTION

Global human population is expected to rise to about 9 billion by the year 2050, possibly accompanied by70% increase in demand for animal proteins (FAO, 2011). Population growth leads to a global increase in food consumption patterns, changes in lifestyles and food preferences (Van Huis, 2013). Poultry production is an area of livestock production, where animal protein production for human consumption is relatively rapid. Egg and meat are sources of high quality protein, vitamins and minerals in human consumption. Ethiopia currently owns about 59.4 million chickens, of which 85.7% are indigenous and the remaining being the improved exotic chicken breed (CSA, 2017). However, currently poultry producers are facing the problem of feed availability and high market price of most of the feed ingredients regardless of the production scales (Khatun *et al*., 2003).

Feed cost in poultry production accounts for more than 70-75% of the total production cost (Abd El-Hack *et al*., 2015).This situation is resulted to the unaffordable of poultry products in developing countries; including Ethiopia. This has also made those countries become more competitive in the global market for the poultry products. Productivity of poultry has also been very much limited in the tropical regions due to scarcity and high price of the conventional protein and energy concentrates (Atawodi *et al.,* 2008). Ethiopia is not exceptional to these circumstances and poultry producers in this country are always complaining over the high cost and quality of poultry feed available in the market.

Energy feed staffs are the most critical and expensive nutrient in poultry ration and the feed's energy content in poultry ration is important because it governs their intake. Energy requirement of poultry could mainly be obtained from cereal grains. On the other side, Ethiopia is not self-sufficient in cereal grains production indicating that poultry production is competitive with human population for the available scarce concentrate food/feeds (Shiferaw *et al.*, 2011). Thus, the use of cereal grains in poultry feeding results in prohibitive market price (Kanengoni *et al*., 2015). Among the cereals, maize is a major grain used in poultry feeding as a source of energy. The double pressure is that maize is the popular cereal grains widely used as human food in Ethiopia. Furthermore, maize availability under the current global condition and in the future is under question due to its high demand for different processing industries (Ekeyem *et al*., 2006).This situation warrants the evaluation of other locally available cheap feed resources and the inclusion of the promising once into poultry feeding. In Ethiopia the production of rice is expanding at a high rate in terms of area coverage, number of sub-districts and number of farmers. The CSA 2011/12 data indicates that the area allocated to grow rice at national level grows from 6,241 hectares in 2005 to 47,739 hectares in 2009, more than six folds expansion. During the same period, output grew from 11,244 to 103,126 tonnes. Mainly, the yield is supposed to increase from 3 tonnes per hectare to 4 tonnes per hectare in 2014 and then to 5 tonnes per hectare in 2019.Therefore Rice bran (RB) is feed resource appealing for inclusion into poultry the ration under the current Ethiopian condition.

Rice *(Oryza sativa)* bran is a common cereal by-product, widely used in rice producing countries as a feed ingredient in poultry ration. Rice bran comprises of a mixture of bran and the germ layers of rice grain after being polished and consists of 8-10% of total paddy weight. It contains considerable amounts of fat, protein, amino acids, metabolizable energy and is a good source of B-group vitamins (Deniz*et al*., 2007; Rezaei, 2006). The high oil and starch content of rice bran make it an important energy feed ingredient for poultry. Its amino acid composition is reported to superior to that of the other cereal grain by-products (Warren and Farrell, 1990a). Rice bran protein is rich in lysine content (4.31%) and the other limiting amino acids including threonine and isoleucine (Parakash, 1996). The nutritional value of rice bran for poultry is higher than that of wheat bran. It contains about 13% of high quality protein, high lipid profile (13%) and Metabolizable energy value of about 2980 Kcal/kg (N.R.C., 1994). Rice bran is light in color, sweet in taste, mildly oily and has a slightly toasted nutty flavor (Cicero and Derosa, 2005). These being the cases the major objective of this experiment was to study the effect of different levels of rice bran on the production performance of Cobb 500 broiler chicken with the following specific objectives:

a) To evaluate the growth performance of Cobb 500 broiler chicken fed different levels of rice bran,
b) To evaluate the feed utilization efficiency and mortality rate of Cobb 500 broiler chicken fed different levels of rice bran.

3. MATERIALS AND METHODS

3.1. Description of the Study Area

This experiment conducted at DZARC, located at 45 km from the south east of capital city, Addis Ababa. It has an altitude of 1900 meters above sea level and at 844'N latitude and 380, 38' E longitudes. The average annual rainfall is 1100 mm and the average maximum and minimum temperature of the area are 28.3 and 8.9°C, respectively (DZARC, 2003).

3.2. Experimental Ration and Treatments

Prior to the experimental starter and finisher ration formulation, chemical composition of samples of the major feed ingredients (maize, RB, soybean, nougseed cake and meal bone and meat) was determined for proximate values of dry matter (DM), Crude fiber (CF), total ash, Ether extract (EE), Kjeldahl N, calcium and phosphorus (Table 3).Dry Matter (DM), Crude Fiber (CF), Ash, Total Fat or Ether Extracts (EE), Crude Protein (CP), Calcium and Phosphorus were determined according to AOAC (2000). About 2g of partially dried samples were weighed into a pre-weighed crucible dish, and dried in an oven at 102°C overnight to determine the DM. Total fat was extracted using Soxhlet apparatus for 6 hour with diethyl ether (boiling point of 34.5°C) and the dried residue was weighed for fat content. Ashing carried out by burning the samples at 600°C for 6 hours and the calcium and Phosphorus were determined after wet digestion by using Atomic Absorption Spectrophotometer. Crude protein content was calculated from the total N multiplied by 6.25. The Metabolizable Energy (ME) content of the feed ingredients and the experimental diets was determined according to Wiseman (1987) as ME (kcal/ kg DM) = 3951+54.4 EE-88.7CF-40.80 Ash.

Then six starters and finishers' treatment rations were formulated based on the results of the laboratory chemical analytical data. The treatment diets were formulated from the feed ingredients such as maize, rice bran, soybean meal, soybean oil, nougseed cake, meat and bone meal, lysine, methionine, limestone, premix general and salt. All the ingredients except the RB were purchased from the nearby market whereas the RB was collected from the cereal millings engaged in rice processing from Wereta area (Fogera District), Amhara region. The maize grain, nougseed cake, limestone and salt were run through a hammer mill sieve with a size of 3-5 mm to produce the meal. The starter phase treatment rations formulated to be nearly iso-caloric and iso-nitrogenous at 3000 kcal/kg DM of ME and CP content of 22%, respectively. The finisher phase treatment rations were also formulated to be iso-caloric and iso-nitrogenous that contains 3200 kcal/kg DM of ME and CP content of 20%, respectively.

3.3. Management of the Experimental Chicks

Three hundred eighty four unsexed day old Cobb 500 broiler chicks with initial body weight of 41.86±1.26 g (mean±SD) were randomly divided into six dietary treatments and four replications per treatment in a completely randomized design experiment, thus having 16 chicks per replicate or pen and a total of 24 experimental pens. Finally the six starters' phase treatment rations were randomly assigned to the experimental chicks for the first 28 days of the feeding trials as shown in Table 1. Then the experimental chicks were switched to finisher's treatment rations for further 28 days of the feeding trial.

Each group of the experimental chicks kept in deep litter (7-10cm) house with enough floor space (1mx2.5m), round feeders and drinkers. Infrared bulbs and fluorescent lumps were used as heat and light source, respectively. The experimental pens, watering and feeding troughs were thoroughly cleaned, disinfected and sprayed against external parasites in advance with the commencement of the feeding trial. The birds were vaccinated against Newcastle and Infectious Bursal Disease (Gumboro) at the recommended vaccination dates, and other health precautions and sanitary measures were also routinely practiced throughout the study period. The chicks initially weighed and allowed to continue with the assigned diets for a 56 days feeding period. Fresh clean water and feed were provided *adlibtum.*

Table 1: Experimental design of the feeding trial with broiler chicks

Treatments	Replications	Birds per replication	Total number of birds per treatment
T_1: Diets + 0% Rice Bran	4	16	64
T_2: Diets + 5% Rice Bran	4	16	64
T_3: Diets + 10% Rice Bran	4	16	64
T_4: Diets + 15% Rice Bran	4	16	64
T_5: Diets + 20% Rice Bran	4	16	64
T_6: Diets + 25% Rice Bran	4	16	64
Total			384

Table 2: Ingredients Used in Formulating the Experimental Diets

Feed ingredients	Starter ration: 0-28 days(CP:22%, ME: 3000kcal/kg DM)						Finisher ration: 29-56 days(CP:20%, ME: 3200kcal/kg DM)					
	Treatments						Treatments					
	T1	T2	T3	T4	T5	T6	T1	T2	T3	T4	T5	T6
Rice bran	0	5	10	15	20	25	0	5	10	15	20	25
Maize	55	50	45.7	40.7	36.7	31.7	60	55	50	45	40	35
SBM	24	28.7	29	30	30	30	17.7	14.7	13.2	15.7	15.2	15.2
NSC	12.7	8	7	5	4	3	9	10	12	11	11	11
Bone and meat meal	3	3	3	4	4	5	8	10	9	7	7.5	7.5
Soybean oil	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	3	3.5	3.5	3.5
Limestone	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Premix	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Methionine	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Lysine	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Salt	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Total	100	100	100	100	100	100	100	100	100	100	100	100
Calculated value												
Cp	21.04	21.34	21.07	21.19	20.82	20.85	19.94	19.86	19.29	18.91	18.83	18.71
CF	4.91	4.98	5.43	5.74	6.18	6.6	4.01	4.59	5.43	6	6.56	7.15
EE	6.71	6.38	6.26	6.18	6.07	6.05	7.24	7.44	7.82	7.93	7.9	7.81
ME	2953.17	2924.28	2911.07	2894.62	2884.65	2870.4	3031.43	3028.08	3043.03	3044.88	3029.58	3011.03
Ca	1.06	1.06	1.06	1.16	1.16	1.26	1.56	1.76	1.66	1.45	1.5	1.5
P	0.58	0.57	0.55	0.58	0.56	0.59	0.79	0.87	0.81	0.7	0.71	0.69

*CF: crude fiber; CP: crude protein; DM: dry matter; EE: ether extract; NSC:Nug seed cake; ME; metabolizable energy; RB: rice bran;SBM:Soyabean meal; T_1: Ration containing 0% RB; T_2: Ration containing 5% RB; T_3: Ration containing 10% RB; T_4: Ration containing 15% RB; T_5: Ration containing 20% RB; T_6: Ration containing 25% RB;**Premix contained: vitamin A, 2,000,000 IU; vitamin D3, 400,000 IU; vitamin E, 1,000 mg; vitamin K3, 400 mg; vitamin B1, 300 mg; vitamin B2, 1,000 mg; vitamin B3, 1,800 mg; vitamin B6, 600 mg; vitamin B12, 2 mg; pantothenic acid, 6,000 mg; folic acid, 200 mg; choline chloride, 40,000 mg; iron, 9,000 mg; copper, 1,000 mg; manganese, 12,000 mg; cobalt, 200 mg; zinc, 14,000 mg; iodium, 200 mg; selenium, 80 mg; Ca, 27.8%; antioxidant (butylatedhydroxytoluene), 500 mg.

3.4. Data Collection

The experimental period lasted for 56 days during which the amount of feed offered and refused per pen recorded daily. The amount of feed consumed determined as the difference between the feed offered and refused. Birds were weighed weekly in a group per pen (replication) and the average BW was calculated. Body weight change was calculated as the difference between the final and initial BWs and the ADG was calculated as BW change divided by the number of experimental days. The FCR computed as the ratio of feed consumption and ADG. Mortality registered as it occurred and general health status monitored throughout the experimental period.

2.5. Statistical Analysis

Data analyzed using the General Linear Model (GLM) procedures of SAS (2002), with the model containing treatments. Differences between treatment means were separated using Least Significant Difference test. The following model was used for the analysis.

$Yij = \mu + Ti + eij$
Where,
Yij = Dependent variable
μ = Overall mean
Ti= Treatment effect of i^{th} treatment and,
eij= Error term

4. RESULTS AND DISCUSSION

4.1. Chemical Composition of Experimental Feed

Chemical composition of the major feed ingredients used in the current experiment is shown in Table 3. According to the results of the current study, the calculated Metabolisable Energy value of rice bran was 2887kcal/kg DM, the energy value of which was 89% of that of maize grain (Table 3). Maize contains a greater energy density than other cereal grains and is usually the standard to which energy content of other cereal grains are compared. The energy value of rice bran was higher than that of all the major feed ingredients used in this study with the exception of that of maize grain. Thus energy value of rice bran seems to be comparable to that of the other cereal grains other than maize. The result of the current study was in agreement with some previous reports that indicate rice bran contains considerable amounts of fat, protein, amino acids, metabolizable energy and is a good source of B-group vitamins (Deniz*et al*., 2007).However, the calculated current ME value (2887kcal/kg DM) of rice bran was lower than that reported by NRC (1994) the value of which was 2980kcal/kg DM.

According to Table 3, rice bran contained 14.09% of crude fiber, the value of which was lower than that of noug (*Guizotia abyssinica*) seed cake (17.2%) and higher than that of all the other major feed ingredients used in the current study. Crude fiber content of feed ingredients is generally used as an index of nutritive value in poultry and monogastric animal feeding (Eze and Ibe, 2005). High crude fiber content indicates low nutritive quality of feed material in poultry feeding. According to Sharif *et al*. (2014) rice bran compositions is largely dependent on the type of rice and efficiency of the milling system and contain 7–11% fiber, the value of which is lower than the crude fiber content reported from the current study. It has been well documented that feeding birds with high content of crude fiber results in lowering nutrient digestibility, growth performance, increase digesta viscosity and wet litter (kras *et al.,* 2013).

The crude protein content of rice bran used in the current study was 6.06%, the amount of which was lower than that of all the other major feed ingredients used in the current study (Table 3). The crude protein content of rice bran recorded from the current study was lower than that reported from rice bran (13%) by NRC (1994). Contrary to the result of the current study, Atteh (2002) reported that rice bran contains 9 - 18% crude protein. According to Jiamyangyuen *et al*.(2005), the protein found in rice bran is reported to be approximately 12-15% and the interesting characteristic of rice bran protein is that it is composed of high amount of lysine, an essential amino acid required in poultry diet. The variation in the nutritional composition of rice bran could be due to variety of the rice grain and nature of the milling process (Amissah *et al*., 2003).

The ether extract content of rice bran used in the current study was 2.6%, the amount of which was lower than that of all the other feed ingredients used in the current study except to soya bean meal (Table 3). The crude fat content of rice bran recorded from the current study was closely similar to that reported by (Sharma *et al.,*2004) from rice bran has (2-2.5%).

The phosphorus content of the rice bran used in the current study was 1.4%, the amount of which was lower than that of all the other feed ingredients used in the current study except that of bone and meat meal (Table 3). The Phosphorus content of rice bran recorded from the current study was lower than that reported by (Stein *et al*., 2015) from rice bran which was high concentration of Phosphorus (1.6-2.2%) relative to the phosphorus contents of other plant based feed ingredients. The phosphorus content obtained in this study was also lower than that of (Juan *et al.,* 2015) who reported that rice bran contains 1.67% phosphorus. The calcium content of the rice bran used in the current study was 0.03 the amount of which was lower than that of all the

other feed ingredients used in the current study (Table 3). The calcium content of rice bran recorded from the current study was lower than that reported from rice bran (0.37) by (Chae *et al*., 2002).

According to the result of the current study, rice bran has potential as source of energy feed in poultry diets, to bridge the huge gap as an alternative energy feed to cereal grains aimed at alleviating the feed shortage thereby minimizing feed cost. Rice bran seems to be capable of replacing larger proportion of maize energy in poultry ration. This in turn will lead to significant savings from the quantity of maize fed to poultry since maize is widely used as staple human food in Ethiopia. Moreover, Ethiopia is not self-sufficient in maize production indicating that poultry production is competitive with human population for the available scarce concentrate food/feeds (Shiferaw *et al.*, 2011). Thus the extensive use of cereal grains mainly maize in poultry feeding results in prohibitive market price in developing country including Ethiopia (Kanengoni *et al*., 2015).

Table 3: Chemical composition of major experimental feed ingredients used in the current study

Feed ingredients	DM	CP	CF	EE	ME	Ca	P
Rice bran	89.2	6.06	14.09	2.6	2887	0.03	1.4
Maize	86.9	8.4	2.3	4.4	3258	0.04	0.3
SBM	88	43.5	6.1	2.2	2180	0.3	0.65
NSC	89.6	34.6	17.2	7	2400	0.26	0.65
BMM	90.5	50	-	14	2830	10.5	5.2

DM: Dry Matter; CP: Crude Protein; EE: ether extract; CF: Crude Fiber; ME: metabolizable energy; ca: calcium; SBM: Soybean Meal; NSC: Nug seed cake; BMM: Bone and meat meal

4.2. Production Performance

4.2.1. Feed consumption

The results of the mean weekly feed consumption of the experimental chicks are presented in Table 4. Statistical analysis of data on feed intake during the starter's period (0-4 weeks) revealed a significant difference among the treatment groups in mean weekly feed intake. There was no significant difference (P>0.05) between all the treatment groups in weekly feed consumption during the first week of the feeding trial with the exception of the group fed on the treatment containing 15% of rice bran. The mean daily feed intake of the group fed on the treatment containing 15% rice bran (15.67g/head) was significantly lower (P<0.05) than that of the groups fed on the treatment containing 0-5% of rice bran during the first week of the feeding trial. There was no significant (P>0.05) difference between all the groups in weekly feed intake during the second week of the feeding trial. During week three the groups fed on the treatment containing 15-25% of rice bran consumed significantly lower (P<0.05) amount of feed than the group fed control diets. The results obtained indicated that there was no significant difference (P>0.05) between the groups fed on the treatment containing 0, 5 and 10% of rice bran in mean feed consumption during the starters period (0-4 weeks). The general tendency was that feed intake was higher for the group fed on control treatment followed by that of the groups fed on the treatments containing 5, 10, 15, 20 and 25%, of rice bran during the starters phase respectively.

As shown in Table 4, there was no significant difference (P>0.05) between all the treatment groups in mean weekly feed consumption during week 5 and 6 of the feeding trial. Starting from the 7th week of the feeding trial, mean weekly feed consumption of the groups fed on the control treatment was significantly lower (P<0.05) than that of all the others (Table 4). In general the groups fed on the treatments containing 0-10% rice bran was significantly higher (P<0.05) than that of the others during starter phase. On the contrary the results of this study showed that the feed consumption of the groups fed on the treatments containing 15-25% rice bran were significantly lower than the others during the starter's period indicating that high level of inclusion of rice bran negatively affected the performance of the experimental chicks.

According to Shaheem *et al.*(2015) and Kaur*et al.*(2011), rice bran has been widely used as an alternative energy source in poultry diet due to its availability and low market price. However, the inclusion of high level of rice bran into broilers diet is limited due to their anti-nutritive contents which are fiber (cellulose and hemicelluloses), phytic acid, trypsin inhibitor, haemagglutinin-lectin protein, polyphenols, tannins, oxalates and saponins. Martin and Farrell, (1998b), recommended that rice bran should not be include in diets of broilers less than 21 days of age.Medugu *et al*. (2011) reported that rice bran can be included 10, 20 and 25% in broiler diets. But the nutrient quality of rice bran can drop easily during storage period due to the presence of lipase, lipoxygenase and peroxidize enzymes that rapidly hydrolyze oil into free fatty acid and glycerol (Bhosale and Vijayalakshim, 2015). The hydrolyzing of rice bran oil ameliorates acidity and causes odor and rancid flavour.

As shown in Table 4, there was no significant difference (P>0.05) between all the treatment groups in mean

weekly feed consumption during5-8 and 0-8 weeks of the feeding trial. The improvement in feed consumption of the groups placed on the treatment containing 15-25% rice bran during finishing phase might be due to adaptation to the anti-nutritional elements of rice bran gradually with time. Van der Meulen and Den Dikken (2004) reported that consumption of high fibre diets resulted in significant increase in feed intake. It is possible that the birds fed the diets with the higher rice bran level (higher in fiber and lower energy), consumed more feed to satisfy their energy needs. Birds usually and primarily consume to satisfy their energy needs. According to the general tendency of the results of the current study, the mean feed consumption (52.28g/head) of the groups fed on the control diet was significantly higher than the others during starters phase, but significantly less (169.06g/head) than the others during finisher phase.

Table 4: Mean feed intake of the experimental Birds (g/bird/day)

Period	Treatments						SEM
Starter	T1	T2	T3	T4	T5	T6	
Week1	19.48^{a}	19.72^{a}	18.91^{ab}	15.67^{b}	16.48^{ab}	17.75^{ab}	2.46
Week2	34.91	34.48	34.24	32.01	30.9	32.16	2.75
Week3	53.72^{a}	48.94^{ab}	49.405^{ab}	46.25^{b}	44.74^{b}	45.13^{b}	4.58
Week4	101^{a}	98.24^{ab}	92.81^{ab}	94.36^{ab}	92.21^{ab}	88.77^{b}	6.82
0-week4	52.28^{a}	50.35^{ab}	48.84^{ab}	47.07^{b}	46.08^{b}	45.95^{b}	3.12
Finisher							
Week5	141.01	137.02	145.15	140.06	137.59	141.37	7.48
Week6	166.4	170.97	176.03	166.43	172.37	169.66	9.78
Week7	169.53^{b}	184.48^{ab}	179.56^{ab}	189.99^{a}	194.56^{a}	194.74^{a}	11.74
Week8	199.31^{ab}	195.32^{b}	209.59^{ab}	224.49^{a}	197.59^{b}	209.03^{ab}	17.21
Week 5-8	169.06	171.95	177.58	180.240	175.53	178.703	9.51
0-week 8	110.67	109.9	113.21	113.66	110.81	113.58	5.43

$^{a-b}$ Means within a row with different superscripts differ significantly (P<0.05); SEM: Standard Error of Mean. T_1: Ration containing 0% rice bran; T2: Ration containing 5% Rice bran; T3: Ration containing 10% rice Bran; T4: Ration containing 15% rice Bran; T5: Ration containing 20% rice bran; T_6: Ration containing 25% rice bran.

4.2.2. Growth performance

The results of the growth performance of the experimental chicks as measured by mean weekly body weight change are presented in Table 5. The results obtained indicated that the mean live body weight attained by the group fed on the treatment containing 25% rice bran was significantly (P<0.05) lower than that of all the others during the first week of the feeding trial. On the other side, there was no significant difference (P>0.05) between all the other treatment groups in mean live weight attained during the first week of the feeding trial. According to Table 7, the mean live body weight attained by the group fed on the treatments containing 20 and 25% of rice bran was significantly lower (P<0.05) than that of the others. Live body weight of 627-650 g/head was recorded from the groups fed on 0-10% of rice bran at the end of the 4thweek of the feeding trial, without showing significant difference (P>0.05) among each other. On the contrary live weight ranging between 565 and 568g/head was attained by the groups fed on 20 and 25% of rice bran at the end of the 4th week of the feeding trial, the values of which was significantly lower (P<0.05) than that of the others (Table 5). During the starters phase (0-4 weeks) birds fed on the control diet were found to be heavier in live body weight and higher in mean daily body weight gain (646g/head and 21.59g/day/head) compared to the groups fed on diets contain 20% and 25% of rice bran. This results indicate that live body weight and means daily body weight gain of the experimental birds were depressed as the levels of inclusion of rice bran increased in the diets during starters phase.

During finishers phase, all the groups of the experimental birds attained live body weight ranging between 1880 and 1910 g/head at the end of the 7thweek of the feeding trial without showing significant difference (P>0.05) among each other. All the groups fed on 0-20% of rice bran attained live body weight of 2.4-2.6 kg/head at the end of the 8th week of the feeding trial. There was no significant difference (P>0.05) between all the treatment groups during the 5-8 and 0-8 weeks of the feeding trial in rate of growth of the experimental chicks as measured by mean body weight attained (Table 5). However, the group placed on the treatment containing 25% of rice bran attained significantly lower (P<0.05) live body weight of about 2.3kg/head on the 8thweek of the feeding trial.

The results of the current study are in agreement with that of (Kaur*et al*., 2011) who reported that phytic acid and dietary fiber were the main anti-nutritive factors found in rice bran. It has been well documented that feeding birds with a high content of fiber resulted in lowering nutrient digestibility, growth performance, increased digesta viscosity and wet litter (kras *et al.,* 2013, Nalle, 2009). Adeola and Cowieson (2011) explained that phytic acid cause limitation in nutrient utilization as a result of binding of the 6 phosphate

groups which makes dietary phosphorus unavailable to the animal. The results of the current study was contrary to that of Salami (2009) who showed that inclusion of 20-30% of rice bran into broiler diets had no adverse effects on production performance. Daliani *et al.*(2012) reported that provision of 35% of rice bran within broilers diet did not significantly affect growth performance. The complimentary effect of other dietary ingredients in the diet and breed of birds used in this study could be responsible for the observed difference in the live body weight of birds. Chae *et al.*(2002) studied the thermal processes of high level of rice bran stabilization and suggested that supplementation with rancid rice meal may impair the performance of animals. Their results demonstrated greater rice bran stabilization through the thermal process, resulted in better animal performance. Yasin *et al.*(2012) and Parveen *et al*. (2013), in evaluating the natural antioxidant in rice bran- based chicken die, depicted that broilers receiving α-tocopherol in the diet gained higher body weight and brought better feed conversion efficiency. Mujahid *et al. (*2003) reported lower fat digestibility values from rice bran stored over longer period of time, the magnitude of the effect of which depended on the level of inclusion in the diet and the thermal processing to which the meal was exposed.

According to Table 5, the inclusion of rice bran at more than 15-20% in broiler diets negatively affected both mean live body weight and mean daily body weight gain both during starters and finishers phases respectively. This result was in agreement with that of Ani *et al.,*(2013) who reported that average daily weight gain was significantly (P<0.05) depressed at the level of inclusion of 20% rice milling waste with enzyme supplementation. The results of the current study was contrary to that of Dafwang and Shwarmen (1996) who recommended rice bran inclusion level of up to 15 and 10% into starters and finishers broilers ration respectively.

Table 5: Performance of the experimental Chicks fed on rice bran (g/bird)

Period	Treatments						SEM
Starter	T1	T2	T3	T4	T5	T6	
Initial weight	41.49	43.48	43.36	40.86	41.41	40.55	2.71
Weight at end of Week1	100.35^{a}	99.06^{a}	97.43^{a}	80.16^{b}	88.46^{ab}	82.58^{b}	9.98
Weight at end of Week2	242^{ab}	251.38^{a}	245.47^{a}	222.37^{abc}	205.54^{c}	215.88^{bc}	19.91
Weight at end of Week3	409.77^{a}	395.39^{a}	395.81^{a}	370.78^{ab}	340.88^{b}	335.55^{b}	36.21
Weight at end of Week4	646.10^{a}	627.74^{ab}	650.31^{a}	589.85^{ab}	568.6^{b}	565.72^{b}	48.70
Daily gain(0-4 week)	21.59^{a}	20.87^{ab}	21.68^{a}	19.61^{ab}	18.83^{b}	18.76^{b}	1.71
Finisher							
Weight at end of Week5	978.52^{a}	941.33^{abc}	998.89^{a}	937.98^{a}	903.46^{bc}	876.19^{c}	59.89
Weight at end of Week6	1315^{ab}	1298.4^{ab}	1354.54^{a}	1303.26^{ab}	1254.86^{ab}	1197^{b}	92.86
Weight at end of Week7	1910.6	1933	1967	1982.7	1909.4	1880.5	161.45
Weight at end of Week8	2644.8^{a}	2632^{a}	2474.5^{ab}	2457.1^{ab}	2473.6^{ab}	2389.9^{b}	159.99
Daily gain(5-8 week)	71.39	71.58	66.94	66.68	68.04	65.15	5.69
Daily gain (0-8 week)	46.69^{a}	46.22^{a}	44.31^{ab}	43.15^{ab}	43.43^{ab}	41.96^{b}	2.86

$^{a-c}$Means within a row with different superscripts differ significantly (P<0.05); SEM: Standard Error of Mean. T_1: Ration containing 0% rice bran; T2: Ration containing 5% Rice bran; T3: Ration containing 10% rice Bran; T4: Ration containing 15% rice Bran; T5: Ration containing 20% rice bran; T_6: Ration containing 25% rice bran.

4.2.3. Feed conversion ratio and mortality rate

The results of the feed conversion ratio and mortality rate of the experimental chicks are shown in Table 6. There were no significant differences (P>0.05) between all the treatment groups during the first 3 weeks of the feeding trial (Table 6). Lower feed conversion ratio of 2.26 was calculated for the groups fed on the treatment containing 10% rice bran during the starter's period, indicating this group produced at cheaper rate compared to the others. During finisher phase, the groups fed on the diet containing 25% of rice bran had feed conversion ratio 2.74 and found to be expensive in production compared to the others (Table 6). During the entire feeding trial of 0-8 weeks the groups fed on control diet and diet containing 5% of rice bran had feed conversion ratio 2.36 and 2.35 respectively, and found to be cheaper in production compared to the others. According to Table 8, significantly higher feed conversion ratio was recorded for the groups fed on 25% of rice bran which comparable to diet containing 10%, 15% and 20% of rice bran and significantly different from control diet and diet containing 5% of rice bran during the entire feeding trial.

According to current study, there was increase in feed consumption with increased levels of inclusion of rice bran which in turn resulted in linearly significant (P<0.05) increase in feed conversion ratio. Duru and Dafwang (2010) reported that rice bran contains high level of fiber which lowered the utilization of protein and energy value of the feedstuff. According to result of the current study, starting from the 7th week of the feeding trial, mean weekly feed consumption of the groups fed on the control treatment was significantly lower (P<0.05) than that of all the others (Table 6). On the other side the group placed on the treatment containing 25% of rice

bran attained significantly lower live body weight of about 2.3kg/head on the 8th of the feeding trial, the value of which was significantly lower (P< 0.05) than that of the others. The general tendency is that live body weight and means daily body weight gain of the experimental bird's depressed and feed intake increased as the levels of inclusion of rice bran increased in the diets. This study showed that higher levels of rice bran inclusion depressed growth and increased feed cost per Kg and resulted in less body weight gain. This result was in agreement with that of Dafwang and Damang (2010), who reported that inclusion 30-40% of rice bran into broilers diet depressed growth and increased feed cost per Kg/ weight gain significantly because of the poor efficiency of feed utilization.

According to Gallinger *et al*. (2004), rice bran is prone to rancidity, has a high phytate content, contains an enzyme inhibitor (trypsin inhibitor), and is high in fiber. These characteristics have limited the use of rice bran in poultry diets. Inclusion of maximum of 10-20% of rice bran into broilers ration was recommended, depending on the geographical origin of the rice and the level of supplemental enzymes used (Martin and Farrell, 1998a).

The analysis of data on mortality revealed that there was no significant difference between all the treatment groups in rate of mortality. The result of the current study is in agreement with that of Mahbub *et al*., (1989) who reported that inclusion of rice bran into broilers diet did not affected the health status of the experimental chicks. The result of the current study indicated that the inclusion of up to 25% of rice bran in broiler diet had no negative implication on the health status and rate of survival of the experimental chicks.

Table 6: Daily mean feed conversion ratio and mortality rate of the experimental Chicks

Period	Treatments						SEM
Starter	T1	T2	T3	T4	T5	T6	
Week1	2.40	2.48	2.57	2.83	2.48	2.95	0.43
Week2	1.74	1.59	1.62	1.59	1.90	1.71	0.24
Week3	2.36	2.39	2.39	2.21	2.65	2.64	0.24
Week4	3.00^{a}	2.66^{ab}	2.55^{b}	3.06^{a}	2.85^{ab}	3.03^{a}	0.28
0-4 week	2.43^{abc}	2.29^{bc}	2.26^{c}	2.40^{abc}	2.45^{ab}	2.59^{a}	0.13
Finisher							
Week5	2.97^{ab}	3.07^{ab}	2.92^{ab}	2.84^{b}	2.90^{ab}	3.20^{a}	0.24
Week6	3.53^{ab}	3.40^{ab}	3.47^{ab}	3.21^{b}	3.44^{ab}	3.74^{a}	0.35
Week7	2.00	2.04	2.06	2.03	2.11	2.00	0.20
Week 8	1.99^{b}	2.04^{ab}	3.22^{ab}	3.71^{a}	2.48^{ab}	3.27^{ab}	1.16
5-8Week	2.59^{c}	2.40^{bc}	2.64^{ab}	2.68^{a}	2.58^{abc}	2.74^{a}	0.18
0-8week	2.36^{b}	2.35^{b}	2.52^{ab}	2.60^{a}	2.53^{ab}	2.68^{a}	0.14
Mortality rate	0.00	3.57	3.57	5.36	3.5	1.79	0.03

$^{a-c}$*Means within a row with different superscripts differ significantly (P<0.05); SEM: Standard Error of Mean. T_1: Ration containing 0% rice bran; T2: Ration containing 5% Rice bran; T3: Ration containing 10% rice Bran; T4: Ration containing 15% rice Bran; T5: Ration containing 20% rice bran; T_6: Ration containing 25% rice bran.*

5. CONCLUSSION AND RECOMMENDATION

5.1. Conclusion

The aim of this experiment was to evaluate the growth performance feed utilization efficiency and mortality of broiler chicks fed different levels of rice bran for duration of 56 days. The results obtained indicated that there was significant difference between the treatment groups in the growth performance and mortality rate. The results obtained also indicated that rice bran can be included at up to 15-20% in starter and finisher broilers diet without detrimental effects on the production performance of the birds. Depending on the growth parameters measured and the availability and market price of rice bran, the use of this by-product in poultry replacing energy value of cereal grains seems to be appealing under the current Ethiopian conditions.

5.2. Recommendation

Based on the results of the current study 15 and 20% of rice bran could safely and economically be included in to starters and finishers broilers ration respectively. Further research is required in the area of treatment of rice bran aimed at the inclusion of higher levels in poultry feeding system in Ethiopia.

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