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PERFORMANCE OF BROILER CHICKENS FED DIET CONTAINING RICE MILLING WASTE FERMENTED WITH VARYING LEVELS OF BAKER'S YEAST (*SACCHAROMYCES CEREVISIAE*)**¹Onunkwo, D. N., ²Mmadubugwu, C. A., ²Nwokolo, C. P., and ³Okocha, O. I**¹College of Animal Science and Animal Production, Michael Okpara University of Agriculture Umudike²Department of Animal science and Technology Nnamdi Azikiwe University, Awka.³Department of Agricultural Education, Federal College of Education, Eha-Amufu, Enugu State.Corresponding Author: donunkwo1@gmail.com Phone number: +234 8033388622.**ABSTRACT**

This study investigated the growth performance of broiler chickens by incorporating rice milling waste (RMW) fermented with baker's yeast (*Saccharomyces cerevisiae*) into their diets. Five experimental diets were formulated, containing 20% RMW and varying levels of baker's yeast inclusion (0%, 2%, 4%, 6%, and 8%). The aim was to assess the potential of fermented RMW supplemented with baker's yeast to replace costly feed ingredients such as maize, thus reducing production costs. One hundred and fifty broiler birds were randomly assigned to the five treatment diets, which were replicated into three groups of ten birds per replicate using a completely randomized design (CRD). The RMW was fermented at 20% with different levels of baker's yeast (2%, 4%, 6%, and 8%) for a period of 24 hours, followed by sun drying for approximately five to six hours. These fermented ingredients were used to formulate diets for experiments 2, 3, 4, and 5, respectively. The broilers were reared in a deep litter system, with ad libitum access to feed and water. The effects of the experimental diets on average daily weight gain were found to be non-significant ($P > 0.05$) across all treatments, although diet 5 (8% yeast inclusion) resulted in higher body weight values (1433.33g and 40.03g). Broilers fed diets containing 0%, 6%, and 8% yeast inclusion exhibited similar feed conversion ratios (FCR) of 1.66, 1.68, and 1.66, respectively, which were significantly lower ($P < 0.05$) than those fed diet 3 (4% inclusion) with an FCR of 70.25g and 2.22g. Overall, the inclusion of 20% RMW and 8% yeast in the diet improved the performance of the broiler chickens. In conclusion, the best growth performance and feed utilization were observed in birds fed a diet with 8% baker's yeast inclusion. This study highlights the potential of using fermented rice milling waste supplemented with baker's yeast as a cost-effective alternative to replace expensive feed ingredients in broiler chicken production.

Keyword: Performance, Broiler chicken, Rice milling waste, Baker's yeast.**Introduction**

In recent years, there has been a growing competition between humans and farm animals for maize and other feedstuffs, as maize serves as a staple food for Nigerians and an important source of energy for livestock (Obioha 1992; Olomu 1995). This competition has led to the search for alternative feedstuffs, posing a challenge to poultry scientists (Akinmutimi and Obioma, 2011). The high cost of conventional feed, which is in demand by both humans and the industry, has resulted in increased expenses for livestock feed and poultry products, ultimately affecting the profitability of farmers (Ojewola and Obasi, 2003).

Rice milling waste (RMW) is a byproduct of the rice milling industry and is typically not utilized, making it a potential feed ingredient in poultry rations. RMW contains a high level of protein, lipids, vitamin B and E, and trace minerals (Warren and Farrell, 1990). The amino acid composition in RMW is comparable to other cereal bran, making it a favorable alternative (Farrell, 1994). However, the nutritional content of RMW can vary due to differences in hull content,

degree of polishing during milling, and rice grain variety.

There has been a growing awareness of using agro-industrial byproducts like RMW to supplement or replace conventional grains, especially maize, in livestock rations (Ukachukwu *et al*, 2003). Researchers have called for the use of suitable feed to meet the nutritional needs of farm animals and mitigate environmental pollution in the area. The cost of feed is not only an important concern for the national economy but also a significant burden for livestock farms. Thus, increasing the use of indigenous feed to reduce the cost of imported feed is a major strategy for developing the livestock industry in developing countries (Goh and Rajion, 2007).

Poultry scientists have employed various techniques, such as feed additives of natural or synthetic origin, in compound feed to enhance weight gain, feed efficiency, nutrient retention, and to decrease mortality rates to meet the protein requirements of the rapidly increasing population. These additives include antibiotics, prebiotics, probiotics, enzymes, and coccidiostats (Saegusa *et al*, 2004). Antibiotic growth

promoters are commonly added to poultry diets to enhance performance, but their use is not cost-effective and raises concerns about bacterial resistance, leading to the ban on antibiotic incorporation in animal feed by the European Union commission (Euc, 2005).

As an alternative to antibiotics, baker's yeast (*Saccharomyces cerevisiae*) has been extensively used as a feed additive in livestock. It is a rich source of crude protein (40%-50%) and contains several water-soluble vitamins (biotin, niacin, and pantothenic acid), which improve the nutritive quality of feed (Walker *et al.*, 2002). Adejumo *et al.* (2005) reported that yeast supplementation during the starter phase of broiler production is more effective in promoting feed conversion and body weight gain compared to the finisher phase. Raju *et al.* (2006) found that up to 200mg of yeast per kg of diet improves feed efficiency in broilers. Additionally, yeast possesses a neutral and attractive flavor, which can enhance the palatability of feed. Thus, using yeast during the fermentation process can help eliminate anti-nutritional factors such as phytic acid in RMW.

Yeast excretes several digestive enzymes that enhance nutrient digestibility, growth rate, and feed conversion ratio in the gastrointestinal tract (Nawaz *et al.*, 2008). From a bacterial origin, lactobacillus and bifidobacterium have the potential to modulate the composition of microbial communities in the gut. Bacterial probiotics form a physical obstruction on the binding sites of the intestinal mucosa, blocking pathogenic bacteria (Lorenzoni, 2012). Yeast targeted primarily at grains or grain byproduct components of diets can directly and indirectly benefit the digestibility of vegetable protein and fibrous matter in the ration. Indirect benefits arise when yeast and metabolic enzymes break down fibrous and nutrient components of the ration (Adejumo *et al.*, 2005). Therefore, this study aims to investigate the influence of various levels of baker's yeast (*Saccharomyces cerevisiae*) fermentation on rice milling waste (RMW) in the diet of broiler birds and observe its effects on the overall performance of the birds.

Materials and Methods

The experiment was carried out in the poultry unit of the Teaching and Research Farm of Michael Okpara

University of Agriculture Umudike, Umuahia, Abia State, Nigeria. Umudike bears the coordinate of 5° 28' longitude North and 7° 32' latitude East and lies at an altitude of 122meters above sea level. The environment of this study is situated within the rainforest zone and is characterized by an annual rainfall of about 2177mm with a relative humidity of about 57-90%. Its monthly maximum and minimum temperature ranges from 27°C-36°C and 20°C-26°C respectively with the month of march witnessing the warmest condition with an average temperature of about 26°C (NRCRI, 2022).

Experimental Animals

One hundred and fifty (150) day old broiler chicks were purchased from a reputable hatchery in Imo state which was used for the research. At arrival of the birds, a proper and normal vaccination regime and drugs administration was observed and followed. The birds were weighed on arrival to get its initial body weight. Then the birds passed through two weeks of the required brooding phase with the appropriate heat and lighting regime. The birds were reared in deep litter system with feed and water given to them *ad libitum* during the experimental period of 8weeks(56days). At the 5-8 weeks phase of the birds, vaccines against Newcastle and Gumboro diseases were given to them.

Experimental Diets

The chicks were randomly assigned to five (5) treatments viz T1, T2, T3, T4, and T5. T1 contained 0% replacer of baker's yeast and RMW, T2, T3, T4 and T5 contained 20% RMW with baker's yeast inclusion at 2%,4%,6% and 8% based on meal respectively. Each treatment was replicated thrice in a CRD with each replicate containing ten (10) birds.

Sourcing and Processing of Materials

About 300kg of rice milling waste (RMW) was collected from Omogho town, Orumba North Local Government Area in Anambra state in a local processing site. The samples were bulked together and fermented with varying levels of baker's yeast (*Saccharomyces cerevisiae*) at 2%, 4%,6% and 8% respectively for twenty-four hours. After which it was sun dried to determine its dry matter content which was used for feed formulation as shown in Table 1 and 2 shown below.

TABLE 1: Percentage Composition of Experimental Diet on Starter Ration (28days)

INGREDIENTS	Diet1	Diet2	Diet3	Diet4	Diet5
MAIZE	61.30	41.30	41.30	41.30	41.30
REPLACEMENT LEVEL%RMW		20	20	20	20
ADDITIVES(YEAST)%		2	4	6	8
SOYABEAN MEAL	20	20	20	20	20
FISHMEAL	5	5	5	5	5
BONE MEAL	3	3	3	3	3

SALT	0.25	0.25	0.25	0.25	0.25
VITAMIN PREMIX	0.25	0.25	0.25	0.25	0.25
METHIONINE	0.10	0.10	0.10	0.10	0.10
LYSINE	0.10	0.10	0.10	0.10	0.10
TOTAL	100	100	100	100	100
CALCULATED					
CP	23.18	23.58	23.58	23.58	23.58
ME(Kcal/kg)	2978.7	2863.7	2863.7	2863.7	2863.7

TABLE 2: Percentage Composition of Experimental Diet on Finisher Ration (56 days)

INGREDIENTS	Diet1	Diet2	Diet3	Diet4	Diet5
MAIZE	53.92	48.00	48.00	48.00	48.00
REPLACEMENT LEVEL%RMW		20	20	20	20
ADDITIVES(YEAST)%		2	4	6	8
SOYABEAN MEAL	23.70	23.70	23.70	23.70	23.70
FISHMEAL	5	5	5	5	5
BONE MEAL	3	3	3	3	3
SALT	0.25	0.25	0.25	0.25	0.25
VITAMIN PREMIX	0.25	0.25	0.25	0.25	0.25
METHIONINE	0.10	0.10	0.10	0.10	0.10
LYSINE	0.10	0.10	0.10	0.10	0.10
TOTAL	100	100	100	100	100
CALCULATED					
CP	20.80	19.81	19.81	19.81	19.81
ME(Kcal/kg)	2959.12	2925.52	2925.52	2925.52	2925.52

The following data were collected on:

Growth performance parameters

The growth parameters were collected and kept obtaining the following parameters such as weight gain, feed intake, feed conversion ratio was recorded and determined by data collection on initial, daily, weekly, and final weight of the broilers. Body weight was calculated between final weight and initial weight. Quantity of feed given was determined. Feed conversion ratio was calculated as the ratio between feed intake and weight gain.

(a) Average Daily Feed Intake (g/bird)

$$= \frac{\text{Quantity of feed given} - \text{Quantity remained}}{\text{Number of birds}(150\text{birds})}$$

(b) Average Daily weight gain (g/bird)

$$= \frac{\text{Final live weight} - \text{initial weight}}{\text{Number of birds}/56\text{days}}$$

(c) Feed Intake

$$= \frac{\text{Quantity of feed given} - \text{leftover}}{\text{Number of birds}}$$

(d) Feed Conversion Ratio (FRC)

$$= \frac{\text{Average daily feed intake /birds}}{\text{Average daily weight gain /birds}}$$

(e) Average Mortality

$$= \frac{\text{Number of dead birds}}{\text{Initial stocks} \times \text{Number of days}}$$

Results and Discussion

Proximate Composition

Proximate constituents of the experimental diets RMW fermented baker's yeast (*Sacchromyces*

cerevisiae) on broiler birds is shown in Table 3. The result of the proximate composition of the experimental diet showed that the dry matter was decreasing as the inclusion level of yeast was increasing across the treatment group, while the ash showed that diet 4 had the highest mean followed by diet 5, diet 3 and diet 2, while diet 1 had the least mean.

The crude protein was most significant ($P < 0.05$) in diet 1, 4 and 5 but had the least value in diet 2 and diet 3. Though there was no level of inclusion of RMW fermented with baker's yeast equivalent in the control diet. hence, it was observed that the experimental diets had cp values below the recommended range of 23+1.0% cp as reported by Olomu and Effiong, (1980); Onwudike, (1983) and Fetuga 1984. The normal crude protein level as reported by Olomu (1995) were within the range of (22-24%) for starter and (19-22%) for finisher which diet 3 did not meet the dietary cp requirements. The crude fat had higher value in diet 2, followed by diet 5 while diet 1,3 and 4 had similar value across the treatment group. The crude fiber was higher in diet 2 and decreased as the yeast inclusion increased, while the diet 1(control) was the least with no inclusion level of RMW and yeast inclusion. The control diet recorded higher nitrogen free extract (NFE) value compared to the experimental diets 2,3,4 and 5 respectively. NFE showed a decreasing value as the level of inclusion of RMW, and baker's yeast increased. The decreased in NFE at a higher level of dietary inclusion of the

baker's yeast and RMW (20%) maybe due to the undigested fiber content in the RMW which was probably not effectively digested by the yeast. The implications of this values in this study maybe because of possible reduction in feed intake or health

issues which may not necessarily depress growth performance. Osei (1992) and Oruwari *et al.*, (1996) respectively indicated that feed intake decreased with an increase in energy level.

Table 3: Proximate composition of experimental diets (Dry matter basis)

Parameters (%)	Diet1 (0 % Yeast)	Diet2 (2 % Yeast)	Diet3 (4 % Yeast)	Diet4 (6 % Yeast)	Diet5 (8 % Yeast)
Dry matter	91.10	90.45	90.35	89.95	89.75
Ash	12.90 ^d	14.49 ^{cd}	16.14 ^{bc}	20.08 ^a	17.89 ^b
Crude protein	22.13 ^a	19.50 ^b	18.65 ^b	21.90 ^a	22.00 ^a
Crude fat	3.45 ^c	4.20 ^a	3.00 ^d	3.35 ^c	3.90 ^b
Crude fiber	5.35 ^c	16.10 ^a	15.50 ^a	14.35 ^{ab}	12.85 ^b
Nitrogen free extract	47.27 ^a	36.16 ^b	37.06 ^b	30.27 ^d	33.11 ^c
Metabolizable energy (Kcal/kg)	3305.26 ^a	3265.18 ^b	3132.04 ^c	3017.89 ^e	3040.30 ^d

Results on growth performance

The performance of broiler chickens fed RMW fermented with varying levels of baker's yeast is presented in Table 4. The initial weight, final weight and average daily weight gained showed that there were no significant differences (P>0.05) across the treatment groups. The result of the daily weight gain showed that broiler chicken fed diet 3 were significantly higher (P>0.05) from each other, while the feed conversion ratio showed that broiler chickens fed diet 1,4 and 5 were significantly lower (P<0.05) than those fed diet 3.

The result of this study showed that the inclusion level of baker's yeast fermented with RMW in the diet at 8% had higher average daily gain. This could be due to the digestive tract activity whereby the baker's yeast in the gut inhibits the growth of the pathogenic microbes by increasing acidity of the intestinal content and providing a pathogenic free intestinal medium for proper functioning of endogenous enzymes to breakdown the nutrients of the experimental ratios which in turn improve body weight as reported by Altaf-Ur-Rahman *et al.*, (2007). The improved beneficial effect of fermented RMW on performance is related to a more efficient use of nutrients which in turn resulted in an improved feed conversion ratio.

The best feed conversion ratio was observed in broiler chickens fed diet 5(8% yeast inclusion). Result of this findings supports Paryad and Mahoudi (2008) who reported increased feed intake in broiler feed supplementing varying levels of baker's yeast (*Sacchromyces cerevisiae*). This result was also in accordance with those of Shareef *et al.*, (2009) who used 2.0% *Sacchromyces cerevisiae* in broiler diet and found a significant increase in feed intake. The feed conversion ratio (FCR) showed improvement in broiler fed diet 3 containing 4% yeast inclusion in terms of feed intake. The similarities or comparable values in the diet 1,4 and 5 whereas a result of lower feed intake in the treatment group.

It was observed that the average daily feed intake increased when broiler chickens were fed diet 3 (4% yeast inclusion) and diet 4 (6% yeast inclusion), while decreased average daily feed intake were observed at a higher inclusion of baker's yeast in diet 5(8% yeast inclusion). This may be due to a balanced ratio of diet 5 which must have met the nutritional requirements of broiler chickens. The better feed conversion ratio (FCR) of the birds using the yeast culture maybe attributed to the digestion of crude protein, which enhanced growth of the birds resulting in feed utilization.

Table 4: Growth Performance of Broiler Chickens fed Rice Milling Waste fermented with Baker's Yeast

Parameters	Diet1 (0%yeast)	Diet2 (2% yeast)	Diet3 (4% yeast)	Diet4 (6% yeast)	Die5 (8% yeast)	SEM
Initial weight g/bird	34.67	31.83	34.20	34.00	32.33	0.35
Final Weight g/bird	1370.00	1271.67	1160.74	1430.00	1433.33	42.83
Daily Weight Gain g/bird/day	38.15	35.42	32.19	39.89	40.03	1.23
Daily Feed Intake g/bird/day	62.79 ^c	64.05 ^{bc}	70.25 ^a	66.56 ^b	65.85 ^{bc}	0.79
Feed Conversion Ratio	1.66 ^b	1.81 ^{ab}	2.22 ^a	1.68 ^b	1.66 ^b	0.08

^{ab} Means within the same row with different superscripts differ significantly at P<0.05; SEM – Standard error of the mean.

Conclusion

This study showed that the supplementation of 8% yeast inclusion to the diet of broiler chickens was beneficial in improving growth, better feed efficiency, improved feed conversion ratio and enhanced digestive enzyme. Thus, the supplementation of this bioactive yeast is an essential practice that can help increase growth, survivability of chickens and enhance product quality.

Recommendation

The present result of this study demonstrated that the bioactive yeast (*Saccharomyces cerevisiae*) at 8% of the diet will be required for broiler chickens.

It is therefore recommended that 8% baker's yeast in broiler diet could be used to improve performance and nutrient utilization. It is also encouraged that farmers should include about 8% baker's yeast in broiler diet in other to improve weight and productivity.

Also, more research should be carried out to explore more on other feed additives that could have beneficial effects on high fiber feed to be fed to broiler birds.

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