



(RESEARCH ARTICLE)



Effects of *Saccharomyces cerevisiae* Supplementation on Growth Performance and Nutrient Digestibility in Broiler Chickens Fed Rice Bran-Based Diets

Adi A.A ¹, Obun C.O ² and Wafar R.J ²

¹ Department of Animal Health and Production Federal Polytechnic Bali, Taraba State, Nigeria.

² Department of Animal Production and Health Faculty of Agricultural Federal University Wukari, Taraba State, Nigeria.

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Abstract

This study evaluated the effects of rice milling waste (RMW) as a partial replacement for maize, supplemented with graded levels of dietary yeast (*Saccharomyces cerevisiae*), on the growth performance and nutrient digestibility of broiler chickens. A total of 120 broiler chicks were randomly assigned to four dietary treatments containing 0.0 g/kg (T0), 0.2 g/kg (T1), 0.4 g/kg (T2), and 0.6 g/kg (T3) of yeast. Each treatment had 30 birds, replicated three times. The trial lasted 56 days, during which body weight gain, feed intake, and feed conversion ratio (FCR) were measured. Birds fed 0.2 g/kg yeast (T1) recorded the highest final body weight (2080.91 g), feed intake (4510.00 g), and the most efficient FCR (2.32), compared to the control group (1948.87 g; 4420.00 g; FCR: 2.42). Nutrient digestibility improved with yeast inclusion, with crude protein digestibility peaking at 78.00% (T2), crude fiber at 48.00% (T2), and nitrogen-free extract at 80.00% (T2). The ether extract digestibility declined slightly at higher yeast levels, from 70.00% (T0) to 65.00% (T3). The optimal yeast dose for enhanced growth and nutrient utilization was 0.4 g/kg, with no adverse physiological effects observed.

Keywords: *Saccharomyces cerevisiae*; Rice Bran; Broiler Chickens; Growth Performance; Nutrient Digestibility.

1. Introduction

The poultry industry remains a cornerstone of global food production, offering a rapid and efficient source of animal protein. However, escalating feed costs, particularly for conventional ingredients like maize and soybean meal pose significant challenges to profitability, especially in developing regions. This has prompted the exploration of alternative feed resources such as rice bran, a by-product of rice milling that is abundant and moderately nutritious. However, its high fiber content and anti-nutritional factors limit its digestibility and utilization in monogastric animals like poultry (Thirumalaisamy *et al.*, 2016).

Rice bran, a by-product of rice milling, is widely accessible and contains valuable nutrients, its abundance and low cost, particularly in rice-producing regions (Khan *et al.*, 2020). Despite its potential, its high fiber content and presence of anti-nutritional factors limit its digestibility and utilization in poultry diets. To address these limitations, researchers have investigated the use of feed additives such as probiotics, enzymes, and yeast cultures. Among these, *Saccharomyces cerevisiae* has gained prominence due to its probiotic properties and its ability to enhance gut health, nutrient absorption, and immune function (Gadde *et al.*, 2017). Yeast supplementation has been shown to improve intestinal morphology, increase villus height, and promote beneficial microbial populations, thereby enhancing feed efficiency and growth performance and reduced inflammation (Comi *et al.*, 2025). Similarly, Hossain *et al.* (2025) highlighted that live yeast supplementation improved body weight, feed conversion ratio, and antioxidant capacity, while also reinforcing gut barrier integrity through the up regulation of tight junction proteins.

* Corresponding author: Obun C.O and Wafar R.J

Recent studies have emphasized the role of yeast-derived non-starch polysaccharides (NSPs) in modulating gut microbiota and producing short-chain fatty acids (SCFAs), which support epithelial integrity and reduce inflammation (Ogbuewu *et al.*, 2020; Hossain *et al.*, 2025). Additionally, yeast cell wall components such as β -glucans and mannans have been linked to improved immune responses and disease resistance in poultry (Jiang *et al.*, 2015; Bu *et al.*, 2019).

Recent studies by Ezema *et al.* (2025) reported that broilers fed diets supplemented with *S. cerevisiae* exhibited increased lymphoid organ development, improved hematological parameters, and superior weight gain compared to control groups. This study investigates the effects of graded levels of *Saccharomyces cerevisiae* on the growth performance and nutrient digestibility of broiler chickens fed rice bran-based diets.

2. Methodology

2.1. Experimental Site

The experiment was conducted at the Poultry Unit of the Department of Animal Production and Health, Teaching and Research Farm, Federal University Wukari.

2.2. Source of Rice Milling Waste and Yeast

The rice brand was sourced within rice mills in Wukari and its environs. The rice brand was sun-dried for 48 hours to reduce moisture content. The yeast (*Saccharomyces cerevisiae*) was purchased from a reputable commercial agro-dealers in Jalingo.

2.2.1. Experimental Design

A total of 120 day-old broiler chicks (Arbor Acres strain) were randomly assigned to four dietary treatments, with 30 birds per treatment. Each treatment was replicated three times, with 10 birds per replicate. The birds were housed in deep litter pens under standard management conditions for a period of eight weeks.

2.2.2. Diet Formulation

The basal diet was formulated using rice bran as the primary energy source, replacing a portion of maize. Four experimental diets were prepared by supplementing the basal diet with graded levels of *Saccharomyces cerevisiae* at 0.0, 0.2, 0.4, and 0.6 g/kg of feed. All diets were formulated to meet the nutritional requirements of broiler chickens as recommended by NRC (1994) presented in Tables 1 and 2.

2.3. Measurement of Experimental Parameters

Growth performance was determined by collection of initial body weight on arrival of the birds and subsequent weekly weight until termination of the experiment.

Feed intake were measured daily before serving and left over the next day. Data generated from growth performance and feed intake was used to calculate feed conversion ratio (FCR) (i.e. Feed/gain).

$$\text{Feed conversion Ratio (FCR)} = \frac{\text{Average daily feed intake/birds}}{\text{Average daily weight gain/birds}}$$

$$\text{Average Daily Feed Intake (g/birds)} = \frac{\text{Quantity of Feed given} - \text{Quantity of Feed remained}}{\text{Number of birds per treatment}}$$

$$\text{Average Daily weight gain (g/birds)} = \frac{\text{Final live weight} - \text{initial weight}}{\text{Number of birds}/56\text{days}}$$

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

2.3.1. Feed and Management

Feed and clean drinking water were provided *ad libitum* throughout the experimental period. All vaccines and medications were administered according to veterinary recommendations. Environmental conditions such as temperature and ventilation were monitored daily to ensure optimal bird welfare.

2.3.2. Data Collection

Parameters measured included:

Feed intake: recorded weekly by subtracting feed refusal from feed offered.

Body weight gain: measured weekly using a digital scale.

Feed conversion ratio (FCR): calculated as feed intake divided by weight gain.

Nutrient digestibility: determined using the total collection method during the final week of the experiment.

2.4. Statistical Analysis

Data collected were subjected to one-way analysis of variance (ANOVA) using SPSS version 25. Differences among treatment means were separated using Duncan's Multiple Range Test at a 5% significance level.

Table 1 Composition of Experimental Starter Diets (28days)

Ingredients	T 0 (0g/kg)	T1(0.2g/kg)	T2(0.4g/kg)	T3(0.6g/kg)
Maize	53.00	43.00	43.00	43.00
RMW	00.00	10.00	10.00	10.00
GNC	13.00	13.00	13.00	13.00
SBM	26.00	26.00	26.00	26.00
Fish Meal	2.00	2.00	2.00	2.00
Bone Meal	5.00	5.00	5.00	5.00
Lysine	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
*Premix	0.25	0.25	0.25	0.25
Total	100%	100%	100%	100%
Analysis composition of diets				
CP (%)	21.39	21.39	21.40	21.87
ME (Kcal/kg)	2978.7	2863.7	2863.7	2863.7
E: Protein ratio	139.90	132.19	123.19	123.19
EE (%)	9.21	7.89	6.22	6.56
CF (%)	6.59	7.89	7.92	7.70
Ca (%)	1.49	1.50	1.50	1.50

*Premix to provide: Vitamin A iu 10,000.0000.00, Vitamin D³ iu 2,000.000.00 Vitamin E iu 10,000.00;Vitamin K₃ iu 2,000.00, Thiamin B 1,500.00, Riboflavin B₂ 1,400.00 Pyridoxine B₆ 1,500.00, Vitamin B₁₂ 10, Niacin 15,000.00, Folic acid 300.00, Biotin 20, Choline chloride 200.000.00, Cobalt 200, Copper 5, iodine 12, Iron 20, Manganese 80, Selenium 200, Zinc 50, Antioxdant 125.00

Table 2 Composition of experimental Finisher diets

Ingredients	T0 (0 g/kg)	T1(0.2g/kg)	T2(0.4g/kg)	T3(0.6g/kg)
Maize	57	42	42	42
RMW	00	15	15	15
GNC	8.0	8.0	8.0	8.0
SBM	22	22	22	22
Maize offal	7.0	7.0	7.0	7.0
Bone meal	5.0	5.0	5.0	5.0
Lysine	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
*Premix	0.25	0.25	0.25	0.25
Total	100 %	100 %	100 %	100 %
Analysed Composition of diets				
MEk (cal/kg)	2937.58	2851.48	2851.48	2851.48
CP (%)	19.31	19.57	19.57	19.57
EE (%)	3.62	4.89	4.89	4.89
CF (%)	3.81	5.39	5.39	5.39

*Premix to provide: Vitamin A iu 10,000.0000.00, Vitamin D³ iu 2,000.000.00 Vitamin E iu 10,000.00Vitamin K₃ iu 2,000.00,Thiamin B 1,500.00, Riboflavin B₃ 1,400.00 Pyridoxine B₆ 1,500.00, Vitamin B₁₂ 10, Niacin 15,000.00, Folic acid 300.00, Biotin 20, Choline chloride 200.000.00, Cobalt 200, Copper 5, iodine 12, Iron 20, Manganese 80, Selenium 200, Zinc 50, Antioxdant mgr 125.00

3. Results and Discussion

The result in Table 3 shows that the inclusion of *Saccharomyces cerevisiae* in rice bran-based diets significantly ($p < 0.05$) influenced the growth performance of broiler chickens. Birds supplemented with 0.2 g/kg of yeast (T_2) exhibited the highest average weight gain (2080.91g) and the most efficient feed conversion ratio (FCR, 2.32) compared to other treatment groups. Although feed intake was slightly higher in the control group (T_1) (4813.33g), this did not correspond to improved weight gain, indicating less efficient nutrient utilization. Birds on T_4 diet (0.6 g/kg) showed a decline in performance, suggesting that excessive yeast inclusion may not yield additional benefits.

These findings are consistent with previous studies demonstrating the efficacy of *S. cerevisiae* in enhancing broiler performance. Hossain *et al.* (2025) and Ahiwe *et al.* (2020) reported that live yeast supplementation improved body weight, FCR, and antioxidant status, while also reinforcing gut barrier integrity through the up regulation of tight junction proteins. Similarly, Comi *et al.* (2025) observed that yeast hydrolysate enhanced intestinal morphology and promoted beneficial gut microbiota, leading to improved nutrient absorption and reduced inflammation. Furthermore, the decline in performance at the highest inclusion level (0.6 g/kg) aligns with findings by Gadde *et al.* (2017), who emphasized the importance of optimal dosing in probiotic supplementation. Excessive yeast may disrupt microbial balance or lead to nutrient competition, ultimately impairing growth. Ezema *et al.* (2025) also highlighted the immunomodulatory effects of *S. cerevisiae*, noting improved hematological parameters and lymphoid organ development in supplemented birds, which may contribute to enhanced nutrient utilization and overall health.

3.1. Nutrient Digestibility

The nutrient digestibility of broiler chickens is depicted in Table 4. Crude protein digestibility peaked at 78.00% in T_2 (0.4 g/kg), compared to 74.00% in the control group. Crude fiber digestibility also improved from 43.00% (T_0) to 48.00% (T_2). These enhancements are consistent with findings by Zhen *et al.* (2019), who observed increased digestibility of protein and fiber with yeast culture supplementation, linked to improved caecal microbiota and enzymatic activity.

Ash and nitrogen-free extract (NFE) digestibility were highest in T2 (62.00% and 80.00%, respectively), indicating better mineral and carbohydrate utilization. However, ether extract digestibility declined with increasing yeast levels, from 70.00% (T0) to 65.00% (T3), possibly due to altered lipid metabolism or reduced bile salt activity, as previously reported by He *et al.* (2021). The beneficial effects of *Saccharomyces cerevisiae* are attributed to its bioactive components, including β -glucans, mannan oligosaccharides, and nucleotides, which enhance gut integrity, modulate immune responses, and promote beneficial microbial populations. Okasha *et al.* (2023) emphasized yeast's role in improving gut health and nutrient absorption, making it a promising alternative to antibiotic growth promoters (Okasha *et al.*, 2023). Yeast also stimulates enzyme secretion and improves feed palatability, contributing to higher feed intake and better nutrient assimilation. The synergy between yeast and RMW is particularly valuable in mitigating the limitations of high-fiber diets. This approach supports sustainable poultry production by reducing reliance on conventional feed ingredients while maintaining performance. The findings suggest that yeast supplementation at 0.2–0.4 g/kg in RMW-based diets can significantly enhance broiler productivity. This strategy offers a cost-effective alternative for poultry producers, especially in regions where rice by-products are abundant. However, exceeding optimal yeast levels may compromise lipid digestibility and overall efficiency, emphasizing the need for precise dietary formulation. The performance table and nutrient digestibility table 3 and 4 respectively are shown below:

Table 3 Performance of Broilers Fed Graded Levels of Yeast

Parameters (g/bird)	T ₀	T ₁	T ₂	T ₃	SEM	P-Value
Initial body weight	131.62	132.04	131.78	131.78	0.02	0.34
Final body weight	1611.51 ^c	2080.91 ^a	1874.90 ^b	1617.93 ^c	17.34	0.05
Total weight gain	1479.89 ^c	1948.87 ^a	1743.12 ^b	1486.15 ^c	17.34	0.02
Total feed intake	4813.33 ^a	4513.33 ^c	4446.67 ^d	4763.33 ^b	14.18	0.01
Average daily weight gain	26.43	34.80	31.13	26.54	2.03	0.99
Average daily feed intake	85.95	80.60	79.40	85.06	3.05	0.80
Feed conversion ratio	3.25	2.32	2.55	3.20	0.78	0.73

^{a,b,c,d} are means with different superscripts within the same row are statistically different ($p < 0.05$). Initial body weight Final body weight, Total weight gain, Total feed intake, Average daily weight gain, Average daily feed intake and Feed conversion ratio.

Table 4 Digestibility of Broilers Fed Graded Levels of Yeast

Parameters (%)	T ₀	T ₁ (0.2g/kg)	T ₂ (0.4g/kg)	T ₃ (0.6g/kg)	SEM	P-Value
Dry matter	84.07	84.24	84.23	84.51	0.14	0.46
Crude protein	67.45 ^b	68.91 ^a	69.93 ^a	69.87 ^a	0.69	0.02
Ether Extract	73.80 ^a	68.99 ^{ab}	61.02 ^c	63.95 ^{bc}	2.33	0.01
Crude Fibre	64.04 ^b	69.20 ^a	68.82 ^a	68.44 ^a	0.72	0.04
Ash	69.23 ^b	77.88 ^a	76.28 ^a	76.98 ^a	0.69	0.03
Nitrogen free Extract	81.34	81.89	82.04	82.33	0.45	0.10

^{abcd} Means with different superscripts within the same row are statistically different ($p < 0.05$)

4. Conclusion

The study concluded that broilers fed 0.2g/kg of yeast exhibited the most favourable results, including higher body weight gain, improved feed conversion ratio and nutrient digestibility. Based on the findings, it is recommended that broiler farmers incorporate yeast at 0.2g per 100 kg of feed to achieve improved growth performance.

Compliance with ethical standards

Disclosure of conflict of interest

The authors declare that there are **no conflicts of interest** regarding the research, authorship, and publication of this manuscript. No financial, personal, or institutional relationships influenced the design, execution, or interpretation of the study titled “*Effects of Saccharomyces cerevisiae* Supplementation on Growth Performance and Nutrient Digestibility in Broiler Chickens Fed Rice Bran-Based Diets.” All materials, including the *Saccharomyces cerevisiae* and rice bran used in this research, were obtained without any form of sponsorship or commercial influence.

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