

Cost-benefit of Using Baker's Yeast (probiotics) and Biotronic® Top Forte (Organic Acid) in Broiler Chicken Feed

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Abstract

The study was conducted to evaluate the cost-saving and performance outcomes of Baker's yeast and Biotronic® Top Forte (BTF) as dietary supplements for broiler chickens during the starter (1-4 weeks) and finisher (5-6 weeks) phases. The study was conducted at the Poultry Unit of the Department of Animal Science Teaching and Research Farm, Faculty of Agriculture, Kaduna State University (KASU), Kafanchan Campus. A total of 132-day-old Cobb 500 broiler chicks were randomly assigned to four treatment groups, fed diets supplemented with 0g (control), 300g of Baker's yeast, 300g of Biotronic® Top Forte, and a combination of 300g each of Baker's yeast and Biotronic® Top Forte. Data collected were analyzed using a one-way analysis of variance (ANOVA) with the significant means separated by Duncan's Multiple Range Test at a 95% confidence level. Results indicated significant differences ($p < 0.05$) across all parameters measured among diets both in the starter (1-4 weeks) and finisher (5-6 weeks) phases. During the starter phase, Baker's yeast diet had the highest feed intake of 0.96kg, with a feed cost of ₦490.20/kg. The total weight gain for this diet was 1.47kg, with a feed cost per kilogram gain of ₦773.49/kg. At finisher phase, the combined treatment diet of 300g each of Baker's yeast and Biotronic® Top Forte had a total feed intake of 1.28kg and a total weight gain of 1.20kg, with a feed cost per kilogram gain of ₦991.66/kg gain. Also, the diet gave a cost saving of ₦24.67/kg gain compared to the other diets. It was concluded that 300g each of Baker's yeast and Biotronic® Top Forte are more economical and are effective in enhancing the growth performance of broiler chickens throughout their growth phases.

Keywords: Performance, Cost Benefit, Baker's Yeast, Biotronic® Top Forte, Feed Additives

1.0 Introduction

The poultry industry confronts considerable problems, particularly owing to the rising feed costs, which may account for up to 70% of total production expenses (Alhotan, 2021; Ebong et al., 2023). This highlights the need for cost-effective alternatives in poultry nutrition, prompting

research into unconventional feed sources that minimally compete with human use (Christopher *et al.*, 2019; Essien *et al.*, 2022). With the rising worldwide demand for chicken products, producers are pursuing creative techniques to improve growth performance while reducing costs. Various strategies have been proposed to address the issue of elevated feed costs, including the utilization of unconventional local feed raw materials (Van der Poel *et al.*, 2020; Essien and Sam, 2018), modification of feed forms and feeding techniques (Abd El-Hack *et al.*, 2022), and the incorporation of feed additives (Ugwu and Okoli, 2017), all aimed at reducing the cost of poultry feed in Nigeria.

Nutritionists and animal production specialists have endorsed the incorporation of feed additives (Pandey *et al.*, 2019) to enhance nutrient absorption from alternative feed source materials for improved output. Feed additives are compounds included in feed to boost feed utilization, efficiency and palatability, or improve metabolism and animal health. Aj-Jaf *et al.* (2019) said that feed additives are used for many purposes, including the enhancement of color and flavor in diets, as well as the modification of growth efficiency and rate in animals. The use of feed additives in compounded feed has become a prevalent technique in the animal feed business. Among these additives, probiotics like Baker's yeast and organic acids such as Biotronic® Top Forte have been the focus of interest in potential benefits to broiler chicken diets (Agbai *et al.*, 2020).

Probiotics, particularly those derived from yeast, like Baker's yeast (*Saccharomyces cerevisiae*), are necessary to enhance gastrointestinal health and nutrient absorption. These probiotics help regulate gut microbiota by promoting the proliferation of beneficial bacterial populations while inhibiting harmful strains (Qui, 2023). This balance not only aids in digestion but also boosts the immune system of poultry for increased growth performance and improved feed conversion ratios (FCR) (Yadav and Jha, 2019). The addition of probiotics is associated with reduced antibiotic dependence, hence answering the concern of consumers concerning antibiotic resistance and contributing toward sustainable poultry farming practices as well (Bâtie *et al.*, 2023).

Organic acids can have different modes of action in poultry nutrition, like those organic acids contained in Biotronic® Top Forte. As preservatives, they increased the stability and shelf-life of feed. They could also decrease the pH in the gastrointestinal tract. This lowers the pH raises the antagonistic environment and makes digestibility easier (Agbai *et al.*, 2020). Research indicates that organic acids enhance nutrient absorption, which consequently results in improved performance among broilers; thus, their incorporation into poultry diets is highly beneficial (Nguyen and Kim, 2020).

The integration of Baker's yeast and Biotronic® Top Forte into broiler diets is aimed not only at optimizing growth performance but also at bringing economic benefits in terms of reduced feed costs per kilogram of live weight produced. As the pressures from all directions on poultry producers to remain profitable increase amidst fluctuating raw material prices and regulatory scrutiny, understanding the cost benefit dynamics of these feed additives becomes even more imperative. This present study evaluates the effects of dietary supplementation with Baker's yeast (probiotics) and Biotronic® Top Forte (organic acid) on the growth performance (feed intake, weight gain, feed conversion ratio), and cost-saving on feed per kilogram weight of broiler chickens during both the starter (1–4 weeks) and finisher (5–6 weeks) phases.

2.0 Materials and Methods

2.1 Experimental Site

This study was conducted at the Poultry Unit of the Department of Animal Science Teaching and Research Farm, Faculty of Agriculture, Kaduna State University (KASU), Kafanchan Campus, Kaduna State. The sites fall within latitude 9° 34'N and longitude 8° 17' E within the Southern Guinea Zone. The vegetation consists of forests and Savannah lands and is located southwest of the Jos Plateau escarpment of the windward region. The town has an altitude of 752m (Peakvisor, 2021). Kafanchan has an average annual temperature of about 25.3° C (77.5 ° F) with average yearly highs of about 28.6°C (83.5°F) and lows of 18.8°C (65.8°F). The town experiences minimal rainfall at the beginning and end of the year, with rainfall occurring mainly between April and October and peaking in August. The town receives a mean annual precipitation of about 1,800 mm and has an average relative humidity of approximately 63% (Junias *et al.*, 2025).

2.2 Source of Experimental Materials and Birds

Major Ingredients used were purchased from Biotin feeds, BR4, Nnamdi Azikiwe Expressway, Kaduna. Maize was purchased at Kafanchan market, in the Jema'a Local Government Area. Baker's yeast was purchased at Samaru Market Zaria. The micro-ingredients such as premix and organic acids (Biotronic® Top Forte (BTF)) were purchased from Fresh Ham Global Farm Emanto Zaria, a poultry additive dealer. One hundred and thirty-two (132) day-old broiler chicks (Cobb 500) were purchased from Olam Hatcheries Limited, Km 25, along the Kaduna-Abuja Expressway. The chicks purchased had an average weight of 42 grams per chick.

2.3 Experimental Diets

Four experimental diets were formulated for both the starter and finisher phases. The diets were supplemented with yeast and BTF at 0g yeast and BTF, 300g yeast, 300g BTF and 300g yeast and BTF each. These four diets were tagged T1, T2, T3 and T4 respectively. T1 is the control diet. The diets were formulated to meet the nutrient requirements as recommended by NRC (1994) for broiler chicken diets. Experimental diets had the same ingredients and nutrient composition. Both starter and finisher diets had the same inclusion levels of the test materials. Table 2.1 shows the diet composition of the broiler starter diet used while Table 2.2 shows the diet composition of the finisher diet used for this experiment.

2.4 Experimental Design and Management of Birds

The chicks were randomly allotted to four (4) treatment groups. Each group was randomly assigned to experimental diets in a completely randomized design. Each group was divided into three (3) replicates of eleven (11) birds per replicate. The diets were labeled T1 to T4 and brooded with a charcoal stove for two weeks. Feed and water were provided ad libitum throughout the experimental period. Vaccination and other routine poultry management practices including daily inspection of the birds for symptoms of disease, and mortality, cleaning of the drinkers and supply of feed and fresh water were maintained. Birds were offered experimental starter diets for four weeks and offered the finisher diets for the next four weeks making a total of 8 weeks of experiment.

Table 2.1: Composition of Broiler Starter Diet Levels of Inclusion of Baker's Yeast and Biotronic[®] Top Forte

| Ingredients | 0g | 300g yeast | 300g BTF | 300 yeast + BTF |
|---------------------------|------------|-------------------|-----------------|------------------------|
| Maize | 56.25 | 56.25 | 56.25 | 56.25 |
| GNC | 11.00 | 11.00 | 11.00 | 11.00 |
| SBM | 28.3 | 28.30 | 28.30 | 28.30 |
| Limestone | 0.50 | 0.50 | 0.50 | 0.50 |
| Bone meal | 2.90 | 2.90 | 2.9 | 2.90 |
| Salt | 0.25 | 0.25 | 0.25 | 0.25 |
| Premix | 0.25 | 0.25 | 0.25 | 0.25 |
| Lysine | 0.25 | 0.25 | 0.25 | 0.25 |
| Methionine | 0.30 | 0.30 | 0.30 | 0.30 |
| Total | 100 | 100 | 100 | 100 |
| Calculate analysis | | | | |
| % CP | 23.0145 | 23.0145 | 23.0145 | 23.0145 |
| ME Kcal/kg | 2900 | 2900 | 2900 | 2900 |
| % E E | 4.69 | 4.69 | 4.6936 | 4.6936 |
| % CF | 4.25 | 4.25 | 4.2464 | 4.2464 |
| % Ca | 1.30 | 1.30 | 1.30 | 1.30 |
| % Lysine | 1.36 | 1.36 | 1.36 | 1.36 |
| % Methionine | 0.96 | 0.96 | 0.96 | 0.96 |

GNC= Groundnut Cake, SBM= Soya Bean Meal, T=Treatment, CP= Crude protein, ME= Metabolization Energy, E E= Ether Extract, CF= Crude Fibre, Ca= Calcium.

2.5 Data Collection

Parameters measured include initial body weight, weekly feed intake and weight gain. Weekly body weight was used to calculate weight gain, while weekly feed intake and weight gain were used to determine the efficiency of feed utilization for the treatment groups. A record of mortality was kept as it occurred throughout the feeding trial. Average weight gain was calculated as the difference between the group's final weight and the initial weight divided by the group's number of birds. Daily weight gain per bird was calculated as average weight gain divided by the number of birds. Average feed intake was calculated as the difference between feed supplied and feed leftover divided by the number of birds. The feed conversion ratio (FCR) was calculated as feed consumed by weight gain while feed cost per kg gain was calculated as FCR multiplied by feed cost.

Table 2.2: Composition of broiler finisher's diet levels of inclusion of Baker's Yeast and Biotronic® Top Forte

| Ingredients | Treatments | | | |
|----------------------------|-------------------|-------------------|-----------------|-------------------------|
| | 0g | 300g yeast | 300g BTF | 300g yeast + BTF |
| Maize | 56 | 56 | 56 | 56 |
| Maize offal | 9.0 | 9.0 | 9.0 | 9.0 |
| GNC | 12 | 12 | 12 | 12 |
| SBM | 18.6 | 18.6 | 18.6 | 18.6 |
| Limestone | 0.5 | 0.5 | 0.5 | 0.5 |
| Bone meal | 3 | 3 | 3 | 3 |
| Salt | 0.25 | 0.25 | 0.25 | 0.25 |
| Premix | 0.25 | 0.25 | 0.25 | 0.25 |
| Lysine | 0.2 | 0.2 | 0.2 | 0.2 |
| Methionine | 0.2 | 0.2 | 0.2 | 0.2 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 |
| Calculated analysis | | | | |
| Crude protein (%) | 19.96 | 19.96 | 19.96 | 19.96 |
| ME Kcal/kg | 2898.72 | 2898.72 | 2898.72 | 2898.72 |
| Ether extract (%) | 4.45 | 4.45 | 4.45 | 4.45 |
| Crude fibre (%) | 4.44 | 4.44 | 4.44 | 4.44 |
| Calcium (%) | 1.32 | 1.32 | 1.32 | 1.32 |
| Lysine (%) | 1.20 | 1.20 | 1.20 | 1.20 |
| Methionine (%) | 0.78 | 0.78 | 0.78 | 0.78 |

GNC= Groundnut Cake, SMB= Soya Bean Meal, ME = Metabolisable energy, T= Treatment. BTF= Biotronic® Top Forte

2.6 Statistical Analysis and Model

All data collected were subjected to a one-way analysis of variance (ANOVA) using the General Linear Model of Statistical Analysis System (SAS) (2013). Differences between means were compared using the Duncan Multiple Range Test.

3.0 Results and Discussion

Table 3.1 presents the cost-benefit analysis for broiler chickens during the starter phase (1-4 weeks) with varying dietary treatments, including Baker's yeast and BTF. Significant differences ($P < 0.05$) were observed in total feed intake, feed costs, total weight gain, feed conversion ratios, and overall cost savings among the diets. The result showed higher feed intake in the diets containing 300g of Baker's yeast additive, with 0.96kg average over 0.91kg for the control diet without additives. The increased feed intake could result from adding the additive ingredient (Baker's yeast) since it is well-reputed in literature to have intestinal health-enhancing effects based on its stimulation of useful gut microflora flora. The microbial balance may be improved

by allowing for better digestion and absorption of nutrients, especially in early development stages when there is an extremely high nutritional requirement (Okey *et al.*, 2023). The addition of yeast into feed significantly enhances palatability, which in turn increases feed intake in young birds. By improving the taste and aroma of the feed, yeast encourages chicks to consume more, supporting their growth and overall health during critical development stages. This increased feed intake can enhance nutrient absorption and performance, especially in young broiler chickens.

On the other hand, feed containing only BTF and the feed with a combination of the two additives had the same consumption rate of 0.92kg. This indicates that, despite their differences in composition, both formulations were equally well accepted by the avian trial subjects, such that BTF is not deleterious to feed intake. BTF has been known for its strong acidic nature, greatly depressing gastrointestinal pH and hence inhibiting pathogens; however, in terms of initial acceptability of feeds, this may not hold as much a role as first thought, compared with probiotics such as Baker's yeast (Agbai *et al.*, 2020). Probiotics enhance palatability by their beneficial effects on intestinal microbiota and overall health, which may lead to increased feed intake (Gul and Durante-Mangoni, 2024). However, this initial difference in the perception of palatability notwithstanding, the overall performance parameters associated with BTF are of interest.

Evidence shows that dietary supplementation of high doses of BTF enhances feed conversion ratios (FCR) and egg-laying rates compared to diets without this additive (Agbai *et al.*, 2021). That suggests, although palatability is not as high at short notice with probiotics, due to its longer-term benefits in improving growth performance and productivity, BTF takes a paramount position in poultry nutrition. The ability to maintain a stable feed intake, coupled with the concurrent improvement in health benefits, makes it a practical alternative to traditional antibiotic growth promoters. This follows modern agricultural practices that aim at reducing antibiotic usage in animal farming.

The range of feed costs varied reasonably widely within the various diets in this study. Although the control diet had the lowest feed cost at ₦482.51/kg, the inclusion of BTF and Baker's yeast was more expensive at ₦508.04 /kg while Baker's yeast diet was at ₦490.20/kg. The high cost can be attributed to the price of BTF and other combinational therapies that promise enhancements in gastrointestinal health with consequential maximization of general productivity in avian species. In particular, the use of organic acids, which have been reported by Ebeid and Al-Homidan (2022) to have the capacity to reduce pH values in the gastrointestinal tract, hence suppressing the pathogenic growth of bacteria, and improving the nutrient absorption capacity of better means. This advantage is not without a higher cost; however, it may not be within the reach of all manufacturers. The mean cost of the baker's yeast diet indicates that it might be cheaper compared to the combination treatment while improving performance. Previous studies have shown that probiotics can improve growth rates and feed conversion efficiency, which may offset their initial costs through better productivity (Al-Shawi *et al.*, 2020). It has been argued that the addition of feed additives, including probiotics, increases feed costs. However, Patel *et al.* (2015) found that dietary supplementation with probiotics significantly improved body weight gain and feed conversion ratios. Thus, while probiotics may increase feed costs, their substantial positive effects on bird growth often defray these additional expenses. Although the control diet

presents the lowest direct cost, poultry farmers must pay proper attention to higher prospects for profitability that might accrue as an effect of improvement in growth variables resulting from Baker's yeast or BTF when formulating diets.

The overall weight gain was highly significant and higher in birds fed with Baker's yeast at 1.47kg compared to other diets ($P<0.05$). The weight gain improvement for this diet could be justified through many mechanisms that may underline the addition of Baker's yeast in feeds. Nutrient utilization is also enhanced through increased activity of digestive enzyme actions brought about by the inclusion of probiotics like Baker's yeast, which will equally stir the gut to absorb the nutrients healthily Onimisi and Ponji, (2019). Eliminating pathogenic bacteria from the gastrointestinal tract enables proper absorption of nutrients, hence reflecting on the growth performance. While the other diets of the control, BTF, and their combination had presented a reduced weight gain with 1.45 and 1.43 kg, respectively. Though there were reports that gut health was enhanced by BTF through acidification and reduction of pH to inhibit the harmful bacteria, the efficacy on weight gain may not be apparent compared to other probiotics like Baker's yeast (Agbai *et al.*, 2020). It corroborates other studies that have also established fact that probiotics have better growth-enhancing advantages than applying organic acids alone (Rodjan *et al.*, 2018; Du *et al.*, 2024).

The feed cost per kg weight gain was analyzed; thus, it can be explained that the diet containing Baker's yeast gave a more favorable cost of ₦773.49/kg against ₦792.29/kg obtained in the control group and ₦803.41/kg when BTF was applied alone. It appears that the inclusion of Baker's yeast improves not just the growth performance but feed conversion efficiency, saving poultry producers more. The cost-saving result showed a saving of ₦22.37/kg gain against negative values with the other diets (-₦7.39 and -₦20.40/kg for BTF alone and in combination, respectively). This shows that using Baker's yeast as a dietary supplement has an economic advantage over and above improving growth performance by reducing feed cost per kilogram gained.

The economic viability of including organic acids in poultry feed has been demonstrated in previous studies. In this respect, Araujo *et al.* (2019) reported a higher cost and revenues were obtained in the use of antibiotics, organic acids presented the lowest production cost among the groups studied and thus may be considered an inexpensive alternative. In a related trial, Ndelekwute *et al.* (2015) found that adding acetic, citric, and formic acid to the diet improved the feed-to-gain ratio, favorably increasing the cost per unit of weight gain. While increased costs per bird and kg live weight emanated from the added expenses over organic acids, the present cost difference and the relative cost advantage were favorable, and may mean economically valuable. These returns are often contingent on realizing optimum growth rates and feed efficiencies-factors are favorably influenced by Baker's yeast in the present study. The major cost savings using Baker's yeast can be ascribed to its ability to enhance overall productivity without unduly increasing input costs. Considering feed is one of the most expensive elements in poultry production, amounting to approximately 70% of total production costs very often, finding efficient ways to improve feed efficiency for broiler production systems to support profitability becomes vital.

Table 3.1: Pull Cost-benefit Analysis for starter phase (1-4 weeks)

| Parameters | Treatments | | | | LOS |
|---|--------------------------|---------------------------|---------------------------|----------------------------|-----|
| | 0g | 300g Yeast | 300g BTF | 300g each of Yeast and BTF | |
| Total feed intake (kg/bird) | 0.91±0.58 ^c | 0.96±5.77 ^a | 0.92±0.87 ^b | 0.92±0.87 ^{bc} | * |
| Feed cost (₦/kg) | 482.51±1.15 ^c | 490.20±0.61 ^{ab} | 499.20±0.61 ^{ab} | 508.04±0.33 ^a | * |
| Cost of total feed intake (₦/kg consumed) | 438.03±0.00 ^b | 471.31±0.00 ^a | 463.77±0.00 ^d | 466.17±0.00 ^d | * |
| Total weight gain (kg) | 1.45±0.67 ^b | 1.47±0.67 ^a | 1.45±1.45 ^c | 1.43±1.20 ^d | * |
| Feed cost (₦/kg gain) | 792.29±0.67 ^b | 773.49±2.02 ^c | 803.41±2.02 ^b | 816.10±2.31 ^a | * |
| Cost saving (₦/kg gain) | - | 22.37±1.17 ^a | -7.39±0.00 ^b | -20.40±0.01 ^c | * |

* Values are presented as means ± SEM. ^{a, b, c, d} were different ($p < 0.05$) within the same row. BTF= Biotronic Top Forte, LOS = Level of significance.

Table 3.2 presents the cost-benefit analysis for broiler chickens during the starter phase (5-6 weeks) with varying dietary treatments, including Baker's yeast and BTF. The results also indicated significant differences ($P < 0.05$) in total feed intake, feed costs, weight gain, feed conversion ratios, and overall cost savings among the diets. While the total feed intake was highest in the diet containing 300g of BTF at 1.30kg, it was closely followed by those receiving a combination of BTF and Baker's yeast at 1.28kg. The lowest intake of 1.23 kg was recorded in the control diet. This is explained by the increased palatability and efficient digestion associated with additives in BTF and yeast-supplemented groups, which are noted to improve nutrient absorption and gut health. Agbai *et al.* (2020) explained that these additives improve palatability and digestion efficiency, hence increasing nutrient utilization and gut health. This agrees with earlier work by Daramola *et al.*, (2018), which indicated increased feed consumption with dietary supplementation during active growth stages. While the control diet had the lowest feed cost of ₦460.28 per kilogram, the combination diet incurred the highest cost at ₦473.65/kg. In the same way, the cost of total feed intake per kilogram consumed was significantly higher under groups supplemented with BTF due to their premium pricing. Notably, although BTF and its combination with Baker's yeast were more costly, while BTF yielded the same weight gains of 1.34kg as in the Baker's yeast treatment, meaning that while costs may be higher, it can be justified by performance outcomes (Onimisi and Ponji, 2019). The feed cost per kilogram of gain was least at ₦991.66/kg for the combined diet, indicating a better feed conversion efficiency to weight gain when both additives are blended. This agrees with a study showing that combining

probiotics and organic acids could maximize growth performance and economic returns in poultry production (Kamel and Mohamed, 2016).

Table 3.2: Pull Cost-benefit Analysis for finisher phase (5-6 weeks)

| Parameters | Treatments | | | | LOS |
|---|---------------------------|---------------------------|---------------------------|----------------------------|-----|
| | 0g | 300g Yeast | 300g BTF | 300g each of Yeast and BTF | |
| Total feed intake (kg/bird) | 1.23±0.58 ^d | 1.27±2.33 ^c | 1.30±1.45 ^a | 1.28±1.73 ^b | * |
| Feed cost (₦/kg) | 460.28±0.32 ^d | 464.42±1.15 ^c | 469.59±0.67 ^b | 473.65±0.67 ^a | * |
| Cost of total feed intake (₦/kg consumed) | 566.31±0.00 ^c | 608.19±0.00 ^a | 608.19±0.00 ^a | 608.87±0.00 ^a | * |
| Total weight gain (kg) | 1.24±1.33 ^c | 1.34±1.33 ^a | 1.34±1.33 ^a | 1.20±1.20 ^d | * |
| Feed cost (₦/kg gain) | 1016.70±2.03 ^a | 1004.20±0.33 ^b | 1019.40±0.88 ^a | 991.66±0.33 ^c | * |
| Cost saving (₦/kg gain) | - | 13.18±0.58 ^b | -2.71±0.00 ^c | 24.67±0.33 ^a | * |

* Values are presented as means ± SEM. ^{a, b, c, d} were different (p<0.05) within the same row. BTF= Biotronic Top Forte, LOS= Level of significance

4.0 Conclusion

In conclusion, the addition of 300g each of Baker's yeast and BTF to broiler diets significantly improved growth performance and economic viability during both the starter and finisher phases. Precisely, Baker's yeast proved effective in enhancing feed intake, weight gain, and feed conversion efficiency therefore; there could be an economical additive for poultry producers. Although in the finisher phase, the combination of BTF and Baker's yeast resulted in higher feed costs, it also brought about comparable weight gains, an indication that these additives work synergistically to optimize growth performance.

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