Influence of baker's yeast (*Saccharomyces cerevisiae*) on performance, carcass characteristics, blood profile and cost-benefit of broiler chicken

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Abstract

Feeding trial was conducted to evaluate the effect of baker's yeast. Baker's yeast (Saccharomyces cerevisiae) is a single cell eukaryotic microorganism classified in the fungi kingdom. It is a probiotic and a possible strategic alternative because of its availability and safety which boost immune level resulting in a better protection against infection .A total number of one hundred and forty (140) 1- day old broiler chicks were randomly allotted into five dietary groups in a completely randomized design to evaluate the effect of yeast (Saccharomyces cerevisiae) supplementation on the growth performance, blood profile and cost benefit of broiler chickens. The experiment lasted for 42 days. Yeast was incorporated into the experimental diets at 0%(T1), 2.5%(T2), 5.0%(T3), 7.5%(T4) and 10.0%(T5)inclusion level to formulate five dietary treatments. Growth performance parameters, carcass characteristics, haematological indices, serum biochemical parameters and economic analysis were assessed. Results showed that birds fed diet containing 7.5% baker's yeast (T4) had the highest weight gain (1322.28g) and the best feed conversion ratio (2.81).Whereas T5 recorded the highest feed cost. Haematological and serum biochemical indices were within the normal ranges across all treatments. The highest profit was obtained in T4suggesting that a 7.5% inclusion level of baker's yeast optimizes growth and economic returns baker's yeast supplementation positively influence broiler performance and profitability without adverse health effect.

Keywords: Broilers, Performance, Cost Benefit, Carcass, Profile.

Influence de la levure de boulanger (*Saccharomyces cerevisiae*) sur les performances, les caractéristiques de la carcasse, le profil sanguin et le rapport coût-bénéfice chez le poulet de chair

Résumé

Une étude d'alimentation a été menée pour évaluer l'effet de la levure de boulanger. La levure de boulanger (Saccharomyces cerevisiae) est un microorganisme eucaryote unicellulaire classé dans le règne des champignons. Elle constitue un probiotique et une alternative stratégique possible en raison de sa disponibilité et de son innocuité, améliorant ainsi l'immunité et offrant une meilleure protection contre les infections. Au total, cent quarante (140) poussins de chair âgés d'un jour ont été répartis aléatoirement en cinq (5) groupes alimentaires selon un dispositif complètement randomisé, afin d'évaluer l'effet d'une supplémentation en levure (Saccharomyces cerevisiae) sur les performances de croissance, le profil sanguin et le rapport coût-bénéfice chez le poulet de chair. L'expérience a duré 42 jours. La levure a été incorporée dans les régimes expérimentaux à des taux d'inclusion de 0 % (T1), 2,5 % (T2), 5,0 % (T3), 7,5 % (T4) et 10,0 % (T5) pour formuler cinq traitements alimentaires. Les paramètres de performance de croissance, les caractéristiques de la carcasse, les indices hématologiques, les paramètres biochimiques sériques et une analyse économique ont été évalués. Les résultats ont montré que les oiseaux nourris avec un régime contenant 7,5 % de levure de boulanger (T4) présentaient le gain de poids le plus élevé (1322,28 g) et le meilleur indice de conversion alimentaire (2,81), tandis que le T5 a enregistré le coût alimentaire le plus élevé. Les indices hématologiques et biochimiques sériques se situaient dans les plages normales pour tous les traitements. Le profit le plus élevé a été obtenu avec le T4, suggérant qu'un taux d'inclusion de 7,5 % de levure de boulanger optimise la croissance et les rendements économiques. La supplémentation

en levure de boulanger influence positivement les performances et la rentabilité des poulets de chair sans effet néfaste sur leur santé.

Mots-clés : Poulets de chair, Performances, Rapport coût-bénéfice, Carcasse, Profil sanguin.

Introduction

Poultry production is often challenged by environmental stress, microbial load, and dietary inconsistencies, which impair nutrient absorption and overall performance (Grashorn, 2010). Antibiotics have historically been used as growth promoters, but their ban due to concerns over antimicrobial resistance and residues in animal products has necessitated the search for natural alternatives (USDA, 2005). Probiotics, particularly *Saccharomyces cerevisiae*, have emerged as promising feed additives due to their ability to enhance gut microbiota, improve nutrient utilization, and strengthen immune function (Fortun-Lamothe and Boullier, 2007). Yeast supplementation in broiler diets has been reported to improve feed efficiency, weight gain, and carcass yield (Shareef and Al-Dabbagh, 2009). However, the economic viability of yeast supplementation in broiler diets requires further investigation.

This study was aimed at assessing the effect of baker's yeast on the growth performance, carcass characteristics, haematological and serum biochemical parameters, and cost-benefit analysis of broiler chickens.

Materials and methods

Experimental design

The study was conducted at the Teaching and Research Farm of Ibrahim Badamasi Babangida University, Lapai, Niger State. A total of 140 1-day-old broiler chicks (Agrited) were randomly allotted to five dietary treatments (T1-T5) in a completely randomized design (CRD), with each treatment replicated four times (seven birds per replicate).

Source of broiler and test ingredients

A total of 140 1-day-old broiler chicks were obtained from Agrited at Minna, Niger State. Maize and soyabean were purchased from Lapai market. Baker's yeast was purchased from Kure market, fish meal, wheat offal, bone meal, limestone, lysine, methionine, vitamin premix and common salt were obtained from Gidan Matasa Feed Ingredients Milling Factory, Minna.

Diet formulation

The diet was designated as T1, T2, T3, T4 and T5. The test ingredient of commercial baker's yeast was incorporated into the diet at different inclusion rates of 0, 2.5, 5.0, 7.5 and 10.0% of diet in a completely randomized design. The feed ingredients in the diet consist of maize, soya bean meal, wheat offal, fish meal, bone meal, limestone, common salt, vitamin premix, methionine and lysine. All the feed ingredients were milled together and mix before being fed at different levels to the broiler chickens. The diet was formulated to give 23% crude protein required for broiler chicks during starter phase (1^{st} to 4^{th} weeks), and 19% crude protein during finisher phase (5^{th} to 6^{th} weeks).

Table 1: Gross composition of experimental starter diet

Ingredients (%)	T_1 (0%)	T_2 (2.5%)	T_3 (5.0%)	T_4 (7.5%)	T_5 (10.0%)
Maize	48.99	48.99	48.99	48.99	48.99
Soyabean meal	34.86	33.96	33.16	32.26	31.46
Yeast	0.00	0.90	1.70	2.60	3.40
Wheat offal	5.00	5.00	5.00	5.00	5.00
Fish meal	5.00	5.00	5.00	5.00	5.00
Bone meal	2.50	2.50	2.50	2.50	2.50

Limestone	2.50	2.50	2.50	2.50	2.50
Vitamin premix	0.25	0.25	0.25	0.25	0.25
Common salt	0.50	0.50	0.50	0.50	0.50
Lysine	0.20	0.20	0.20	0.20	0.20
Methionine	0.20	0.20	0.20	0.20	0.20
Total	**100**	**100**	**100**	**100**	**100**
Calculated values					
Crude protein (%)	23.05	22.94	22.85	22.74	22.64
ME(Kcal/kg)	**2749.17**	**2748.45**	**2747.81**	**2747.09**	**2746.45**

Table 2: Gross composition of experimental finisher diet

Ingredients (%)	T_1 (0%)	T_2 (2.5%)	T_3 (5.0%)	T_4 (7.5%)	T_5 (10.0%)
Maize	54.00	54.00	54.00	54.00	54.00
Soya bean meal	24.70	24.10	23.46	22.85	22.23
Fish meal	2.00	2.00	2.00	2.00	2.00
Yeast	0.00	0.60	1.24	1.85	2.47
Bone meal	2.5	2.5	2.5	2.5	2.5
Wheat offal	15.0	15.0	15.0	15.0	15.0
Lime stone	1.0	1.0	1.0	1.0	1.0
Vitamin premix	0.25	0.25	0.25	0.25	0.25
Common salt	0.25	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10	0.10
Methionine	0.20	0.20	0.20	0.20	0.20
Total	**100**	**100**	**100**	**100**	**100**
Crude protein (%)	18.78	18.71	18.64	18.56	18.49
ME (kcal/kg)	2764.20	2763.72	2763.21	2762.72	2762.22

Experimental broiler birds and management

One hundred and forty 1-day-old broiler chicks (Agrited) were randomly allotted in to five dietary treatments (T_1, T_2, T_3, T_4 and T_5) in a complete randomized design (CRD) with seven (7) birds per replicate and twenty-eight broiler chicks per treatments. Each treatment had four replicates. The broiler chickens were housed in a pen with a concrete floor covered with used newspapers, every hole blocked to avoid predators like snakes and rats. The roof was made with zinc and overhead. The pen was disinfected thoroughly with disinfectants (germicides) for 5 days prior to the arrival of the broiler chickens. Prior to the commencement of the experiment, the floor was covered with rice bran and old newspaper also covered with polythene after the disinfection so that it was effective. The pen was opened prior to the arrival of the birds; heat was supplied in the pen to keep it warm before and after the arrival of the broiler birds. Feed was supplied on flat feeders and water containing glucose was supplied as anti-stress.

Data collection

Growth performance parameters, including feed intake, weight gain, and feed conversion ratio, were recorded weekly. Mortality was documented. At six weeks, two birds per replicate were randomly selected for carcass and organ weight evaluation. Blood samples were collected from the wing vein for haematological and serum

biochemical analysis using an auto-haematology analyzer.

Feed intake

A known quantities of feed was usually offered every day and the left over was equallymeasured the next day. The difference between the feed offered and the leftover was considered as feed intake.

Average feed intake was calculated using the formula below.

$$\text{Average feed intake (g)} = \frac{Quantity\ of\ feed\ given\ (g) - Quantity\ of\ Leftover\ (g)}{Number\ of\ Birds}$$

This was calculated from the body weight data. Body weight gain was obtained by subtracting the previous week body weight from the current week body weight.

Body weight gain (g) = Present week weight (g) – previous week weight (g)

Fed conversion ratio is computed as the ratio of feed intake to body weight gain (g).

$$\text{Feed Conversion Ratio (FCR)} = \frac{Average\ weekly\ feed\ intake\ (g)}{Average\ weekly\ weight\ gain\ (g)}$$

$$\text{Mortality (\%)} = \frac{number\ of\ dead\ birds}{initial\ number\ stocked} \times 100$$

Carcass quality/organ weight evaluation: the carcass quality was evaluated using the procedures reported by Akinmutimi et al.,(2006) this was done by randomly selecting two broiler birds from each replicate, off feed over night in order to clear their gut content before slaughter. The cut-up parts: thigh, drumstick, breast muscle, wings and back were weighed separately. The visceral organs heart, abdominal fat, pancreas, proventiculus, gizzard, liver, kidney, intestine, were also weighed and were all expressed as dressed weight percentage of the carcass. *That is*

$$\text{Cut-up part} = \frac{value\ of\ cut{-}up\ part}{carcass\ weight} \times 100$$

$$\text{Visceral organs (\%)} = \frac{visceral\ parts}{live\ weight} \times 100$$

The blood samples for haematology were collected in Ethylene Diamine Tetra Acetic acid (EDTA) embedded bottles while those for serum bio-chemistry were collected in bottles without EDTA. The analyses were carried out at the Hematology laboratory section of the Niger State Veterinary Hospital, Minna, Niger State.

At the end of the 6th week of experiment, blood samples were obtained via the wing vein of randomly selected birds. Two chickens from each replicate giving a total of forty (40) blood samples. The birds were randomly selected and the bottles were used in collecting the blood, the bloods were collected intravenously for laboratory analysis. The blood parameters considered include; Haemoglobin (Hb), white blood cell count (WBC), packed cell volume (PCV) and red blood cell (RBC) count for hematological parameters, neurophyls, monocytes, lymphocytes, MCH, MCV, and MCHC were analyzed by an auto hemoanaliser (BC- 3000plusMindray Auto Hematology analyzer). The serum biochemistry parameters analyzed included; Total protein, albumen, globulin cholesterol ALT, AST, SGOT and SGPT and these was determined using procedure by Ewuola and Egbunike (2008)

Cost-benefit analysis

Feed cost, total revenue, and net profit were calculated to determine the economic feasibility of baker's yeast inclusion.

Statistical analysis

Data collected on performance, carcass characteristics, blood profile, and cost-benefit of broiler chicken were analyzed using Analysis of Variance (ANOVA) through SPSS software (version 26). Differences among treatment means were determined using Duncan's Multiple Range Tested. A significance level of $p<0.05$ was

adopted, ensuring that the results will be statistically relevant (Okonkwo *etal*, 2022).

Results

Growth performance

Broilers in T4 (7.5% yeast) had the highest final weight gain (1322.28g), significantly ($p < 0.05$) outperforming other treatments. The best FCR (2.81) was also recorded in T4, indicating improved feed utilization.

Table 3: Growth performance of broiler chickens fed baker`s yeast to replace part of soyabean meal

Parameters	T1	T2	T3	T4	T5	SEM	LSD
Live wt(g)	997	1020	1299	1489	1100	0.00	0.00
IWG (g)	39.57	39.35	39.13	39.28	39.06	0.45	0.82
FWG (g)	938.25^{C}	992.50^{c}	1189.80^{ab}	1322.28^{a}	1048.80^{bc}	66.42	0.00
BWG (g)	898.68^{c}	953.14^{c}	1150.60^{ab}	1283.50^{a}	1009.1^{bc}	66.53	0.00
FI (g)	2826.30^{d}	2956.10^{c}	3352.20^{b}	3564.40^{a}	3299.50^{b}	30.60	0.00
FCR	3.14^{ab}	3.10^{ab}	2.92^{ab}	2.81^{b}	3.29^{a}	6.19	0.17
Mortality (%)	14.29	0.00	0.00	0.00	0.00	0.00	0.00

Means with no superscripts on the same row does not differ significantly (P>0.05), a, b: means with different superscripts on the same row differ significantly (P<0.05). IWG= initial body weight FWG= final bodyweight BWG= body weight gain, FI= feed intake, FCR = feed conversion ratio SEM = Standard Error of Means, LSD = Level of significance difference.

Carcass characteristics

Carcass traits showed significant ($p<0.05$) improvements with yeast supplementation. The highest dressing weight (1300g) was observed in T4, while T3 had the highest dressing percentage (98.17%) while lowest value of (80.77%) was recorded in T1.

Table 4: Cut-up parts of broiler chickens fed baker's yeast to replace part of soyabean meal

Parameters	T1	T2	T3	T4	T5	SEM	LSD
Dressed wt. (g)	838.25^{b}	844.25^{b}	1066.00^{a}	1173.80^{a}	921.00^{b}	62.97	0.00
Dressing (%)	83.46	85.06	89.88	86.92	86.75	3.15	0.37
Wing (%)	8.55^{d}	9.80^{bc}	11.14^{a}	10.90^{ab}	8.93^{dc}	0.55	0.00
Drumstick (%)	10.58	11.00	11.34	11.66	11.05	0.66	0.58
Thigh (%)	12.69	12.74	14.03	13.87	13.37	0.83	0.38
Breast (%)	15.80^{b}	19.87^{ab}	17.84^{ab}	18.43^{ab}	19.47^{b}	1.26	0.04
Back (%)	16.68^{b}	17.79^{b}	17.30^{b}	20.41^{a}	16.64^{b}	1.11	0.02

Means with no superscripts on the same row does not differ significantly (P>0.05), a, b: means with different superscripts on the same row differ significantly (P<0.05). SEM = Standard Error of Means, LSD = Level of significance different.

Table 4.Shows the percentage weights of heart, proventiculus, intestine, spleen, liver, gizzard, and abdominal fat differed significantly ($p<0.05$) across the dietary treatment levels. There was no significant difference ($p>0.05$) in the percentage weight of lung and kidney, however higher percentages of (0.99%) and (0.99%) of lung and kidney were recorded in treatment two respectively. Highest percentage weight of gizzard (4.50%), intestine (12.01%) were recorded in treatment one pancreas (0.30%) where recorded in treatment one, two and five, respectively.

Table 5: Visceral organs of broiler chickens fed baker's yeast to replace part of soyabean meal

Parameters(%)	T1	T2	T3	T4	T5	SEM	LSD
Heart	0.74^{a}	0.65^{ab}	0.60^{ab}	0.49^{b}	0.62^{ab}	0.06	0.02
Pancreas	0.30	0.30	0.21	0.20	0.30	0.05	0.26
Lung	0.80	0.99	0.92	0.63	0.77	0.14	0.18
Spleen	0.61^{b}	0.18^{a}	0.18^{a}	0.20^{a}	0.20^{a}	0.02	0.07
Proventiculus	1.11	1.90	0.98	0.91	0.96	0.017	0.17
Gizzard	4.50^{a}	3.79^{b}	3.45^{b}	3.44^{b}	3.56^{b}	0.25	0.00
Liver	2.51^{ab}	2.40^{ab}	2.32^{ab}	2.10^{b}	2.66^{b}	0.185	0.08
Kidney	0.85^{a}	0.99^{ab}	8.00^{b}	0.97^{b}	0.95^{b}	4.39	0.42
Abdominal fat	0.72^{b}	0.55^{b}	1.18^{a}	0.71^{b}	0.91^{ab}	0.20	0.06
Intestine	12.01	10.50	9.08	8.96	9.45	0.76	0.01

Means with no superscripts on the same row does not differ significantly (P>0.05), a, b: means with different superscripts on the same row differ significantly (P<0.05). SEM = Standard Error of Means, LSD = Level of significance difference.

Haematological and serum biochemical parameters

Haematological indices, including packed cell volume (PCV), haemoglobin (Hb), and white blood cells (WBC), were within normal physiological ranges. Birds in T5 had the highest Hb and PCV values, indicating no adverse effects on health. Serum protein and albumin values were consistent across treatments.

Table 6: Haematology parameters of chickens fed baker`s yeast to replace part of soyabean meal

Parameters	T1	T2	T3	T4	T5	SEM	LSD
White blood cells ($\times 10^{9}$/L)	3.80	3.40	3.80	3.95	4.20	0.40	0.47
Packed cell Volume (%)	35.00	33.50	35.50	37.50	37.50	2.20	0.40
Haemoglobin (g/dL)	11.65	11.10	11.80	12.45	12.50	0.71	0.37
Red blood cells ($\times 10^{12}$/L)	5.800	5.559	5.900	5.95	6.25	0.42	0.62
Neutrophilis (%)	36.50	35.00	36.00	37.00	37.50	1.61	0.62
Lyphocytes (%)	23.00	22.00	24.00	24.50	24.00	1.61	0.20
Monocytes (%)	2.50^{ab}	2.00^{b}	2.50^{ab}	2.50^{ab}	2.50^{a}	0.63	0.89

[a, b, c:] Means with different superscripts on the same row differ significantly (P<0.05), S.E.M=Standard error of mean, LSD= level of significance difference,

Table 5 shows the serum biochemistry parameters (total protein, albumin and globulin). The results demonstrated that there were no significant differences (p<0.05) in the values of total protein albumin and globulin for the five dietary treatments. For the values of total protein observed T_4 and T_5 had the highest value (6.15g/mL) while T_3 had the lowest value (5.65g/mL). For the values of albumin observed T_4 had the highest value (2.40mg/dL) while T_3 had the lowest value (1.70mg/dL). For the values of globulin observed T_3 had the highest value (3.95g/mL) while T_2 and T_4 had the lowest value (3.75g/mL).

Table 7: Serum biochemistry parameters of chickens fed baker's yeast to replace part of soyabean meal

Parameters(g/mL)	T1	T2	T3	T4	T5	SEM	LSD
Total protein	5.90	5.95	5.65	6.15	6.15	0.27	0.42
Albumin	2.00	2.26	1.700	2.40	2.35	0.27	0.20
Globulin	3.90	3.75	3.95	3.75	3.80	0.23	0.87

a, b: Means with different superscripts on the same row differ significantly (P<0.05), S.E.M= Standard error of mean, LSD= level of significance difference, TP= Total Protein, GL= Globulin.

Cost-benefit analysis

The cost of feed increased with yeast inclusion, but T4 yielded the highest profit margin, making 7.5% the most cost-effective inclusion level.

Table 8: Cost benefit of chickens fed baker's yeast to replace part of soyabean meal

Parameters (g)	T1	T2	T3	T4	T5	LSD	EM
Final live weight (Kg)	0.94^{e}	0.99^{d}	1.19^{b}	1.32^{a}	1.05^{c}	0.00	0.22
Total feed consume (g) /bird	3.15^{b}	3.10^{c}	2.92^{d}	2.82^{e}	3.29^{a}	0.00	0.18
Cost/kg feed(#)	1172.38^{e}	1205.93^{d}	1238.53^{c}	1271.98^{b}	1310.10^{a}	0.00	0.02
Cost/kg feed consumed/bird(#)	3692.90^{c}	3738.38^{b}	3616.51^{d}	3586.98^{e}	4310.23^{a}	0.00	0.01
Cost of production	4150.80^{e}	4311.90^{c}	4577.05^{b}	4644.00^{a}	4200.00^{d}	0.00	0.02
Revenue (#)	4222.13^{e}	4466.25^{d}	5354.10^{b}	5940.00^{a}	4719.60^{c}	0.00	0.02
Profit (#)	71.33^{d}	154.35^{c}	777.05^{b}	1296.00^{a}	519.60^{c}	0.00	0.02

Revenue was based on 4500/kg

$^{a, b, c, d, e}$: Means with different superscripts on the same row differ significantly (P<0.05),S.E.M= Standard error of mean, LSD= level of significance difference.

Discussion

The study investigated the effects of dietary supplementation of baker's yeast (*Saccharomyces cerevisiae*) on the growth performance, carcass characteristics, blood profile, and economic feasibility of broiler production. Results indicated that yeast inclusion at 7.5% significantly enhanced broiler weight gain (1322.28g) and improved feed conversion ratio (2.81), suggesting that yeast acts as a probiotic, enhancing gut microbiota, digestion, and nutrient absorption (Owens *et al.*, 2019). Birds in the 7.5% treatment group also recorded the highest dressing weight (1300g) and dressing percentage (98.17%), indicating improved carcass yield and muscle development (Paryad and Mahmoudi, 2008).

Haematological and serum biochemical parameters remained within normal physiological ranges across all treatments, demonstrating that baker's yeast did not negatively impact broiler health (Toghyani *et al*., 2011). Notably, birds in the 10% yeast group exhibited the highest hemoglobin and packed cell volume values, suggesting a potential immune-enhancing effect. However, performance declined slightly at this level, likely due to reduced diet palatability or excessive fiber content.

From an economic perspective, although feed cost increased with higher yeast inclusion, the 7.5% supplementation level provided the highest

profitability due to improved feed efficiency and higher weight gain (Al-Natour and Abujamous, 2022). This makes 7.5% yeast inclusion the most cost-effective strategy for optimizing broiler production.

Conclusion

The results obtained from the study indicates that broilers could be raised on baker's yeast at 7.5% inclusion level without having any adverse effect on the growth performance, feed conversion ratio, carcass characteristics, and health of broiler chicken. The inclusion of yeast in the diet of broiler chicken had no deleterious effect on their haematological and serum biochemical indices. The result indicated that it is more economical for a farmer to employ 7.5% inclusion level in order to minimize production cost and enhance more profit.

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