EFFECT OF ACIDIFIER SUPPLEMENTATION TO LOW CRUDE PROTEIN DIET ON GROWTH PERFORMANCE AND BLOOD CHEMISTRY OF BROILER FINISHER CHICKENS

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ABSTRACT
An experiment was conducted to investigate the effect of graded levels of acidifier (AF) supplementation to low crude protein diet (LCPD) on growth performance, cost-benefit, and blood chemistry of broiler finisher chickens (21 to 49 days old). A total of 200, 21-day-old Arbor acre broiler chicks were randomly distributed into five dietary treatments of four replicates with 10 birds each in a completely randomized design. Five isocaloric diets were formulated to comprise: 1) Positive Control (PC, 20% CP), 2) Negative Control (LCPD, 16% CP), 3) LCPD + 100 mg/kg AF, 4) LCPD + 200 mg/kg AF, and 5) LCPD + 300 mg/kg AF. Data collected on performance and serum biochemistry were statistically analysed using one-way ANOVA by the SPSS statistical package and treatment means differences were compared using Duncan's multiple range tests. The result showed that average final weight (AFW), average weight gain (AWG) and feed conversion ratio (FCR) were significantly ($p<0.05$) affected by AF supplementation to LCPD. Birds fed PC diets and LCPD+3% AF diets recorded higher ($p<0.05$) AFW and AWG with lower FCR than those fed LCPD diets. Cost/kg gain was significantly lower ($p<0.05$) in birds fed LCPD without and with addition of AF than PC diet. Increasing level of AF at 300 mg/kg in SDPD resulted to higher ($p<0.05$) concentration of total protein and globulin with corresponding decrease ($p<0.05$) in urea nitrogen concentration compared to those fed LCPD. Therefore, it could be concluded that dietary reduction of CP level from 20% to 16% with acidifier supplementation up to 300 mg/kg positively influenced performance and blood biochemical indices, at lower cost/kg gain for broiler finisher chickens.
Keywords: Broiler finishers, Low crude protein, Acidifier, Performance, Blood.

INTRODUCTION
The increase in global concerns regarding the increasing price of protein feedstuffs, climate change resulting to heat stress, environmental pollution caused by the excretion of excessive nitrogen, and the production of greenhouse gasses, are becoming major issues that could be confronted by using reducing crude protein (CP) levels in poultry diet (Mottet and Tempio, 2017; Attia *et al*., 2020; Woyengo *et al*., 2023). Thus, reducing the crude protein (CP) content of broiler diets offers a promising strategy to safeguard the sustainability of chicken meat production (Woyengo *et al*., 2023). Low-CP diets (LCPD) have the potential to attenuate environmental pollution from nitrogen and ammonia emissions, and can diminish the global chicken-meat industry's dependence on soybean meal to a tangible extent (Chrystal *et al*., 2020). However, usage of LCPD in the order of 3 to 4% reduction of dietary CP despite meeting the requirements of limiting amino acids still harms growth performance, carcass traits, morphology of intestinal villi and profitability (Dean *et al*., 2006; Chrystal *et al*., 2020; Woyengo *et al*., 2023). Thus, to overcome the negative impact of feeding LCPD, the strategy will be possibly beneficial when it is combined with organic feed additives particularly acidifiers to improve protein digestibility, production cost, and environmental impact (Mahfudz *et al*., 2020; Gao *et al*., 2021; Kop Bozbay *et al*., 2024; Yalçınkaya *et al*., 2025). Acidifiers are weak organic acids that are beneficial in increasing feed quality and utilization, safety conditions, and production performance in chickens by decreasing gastric pH and reducing the microbial pathogens in the gastrointestinal, particularly gram-negative bacteria (Heidari *et al*., 2018; Xue *et al*., 2023; Sedghi *et al*., 2024). Therefore, this study was conducted to examine the response of broiler finisher chickens fed LCPD with graded levels of acidifier supplementation on growth performance and blood chemistry.

MATERIALS AND METHODS
This study was carried out at the Poultry Unit of the Research Farm of Department of Animal Production Technology. Federal College of Wildlife Management, New Bussa, Niger state. A total of 220 day-old Arbor Acres broiler chicks were purchased from a reputable hatchery in Ibadan. The birds were raised on commercial starter feed for the first 21 days. Thereafter, the 200 birds were selected on weight basis and allocated into five dietary treatments and each treatment replicated four times with 10 birds per replicate in a completely randomized design. Two basal diets were formulated to be isocaloric according to NRC (1994) recommendation to comprise a positive (T_1) and negative (T_2) control diets containing 20 and 16 % CP levels, respectively. The other three diets were formulated by supplementing acidifier to the negative control diet at 100, 200 and 300 mg/kg as T_3, T_4 and T_5 respectively (Table 1). The acidifier used in the study is a commercial product from CIFEK International, Lagos,

Nigeria. The birds were housed in an open-sided pen facility under a deep litter management system. Feed and water were made available *ad libitum* for a period of 28 days of the experimental period. Body weight and feed consumption of chicks were recorded on a group basis, and feed intake, body weight gain (BWG), and feed conversion ratio (FCR) were calculated from these data at the end of the experimental period. At the end of the feeding trial, 2 mL of blood from their wing veins from the three chickens per treatment group were collected using a sterilized syringe into test tubes without anticoagulant and centrifuged at 3000 rpm for 15 minutes at +4 °C and, stored in Eppendorf tubes at -80°C until analysis to determine total protein (STP), albumin (SAB) and urea nitrogen (SUN) using commercial kits. Data collected were statistically analysed in a completely randomized design using one-way ANOVA by the SPSS statistical package for Windows, Version 21.0. Variations among treatment means were separated using Duncan's multiple range tests and the statement of statistical significance was pronounced at P<0.05.

Table 1: Ingredient Composition of Experimental diet

Ingredients	**T_1**	**T_2**	**T_3**	**T_4**	**T_5**[h3]
Maize	59.70	66.60	66.50	66.40	66.30
Soybean	29.00	21.00	21.00	21.00	21.00
Fishmeal	2.00	2.50	2.50	2.50	2.50
Groundnut oil	3.00	3.00	3.00	3.00	3.00
Acidifier	0.00	0.00	0.10	0.20	0.30
Dicalcium phosphate	2.50	2.50	2.50	2.50	2.50
Limestone	1.50	1.50	1.50	1.50	1.50
Inert filler	1.00	1.00	1.00	1.00	1.00
Salt	0.30	0.30	0.30	0.30	0.30
Methionine	0.30	0.60	0.60	0.60	0.60
Lysine	0.20	0.50	0.50	0.50	0.50
Premix	0.50	0.50	0.50	0.50	0.50
Total	100.00	100.00	100.00	100.00	100.00
CP, %	19.45	16.92	16.91	16.90	16.89
ME, Kcal/kg	3052.67	3057.51	3054.29	3051.07	3047.86

RESULTS AND DISCUSSION

The growth performance and serum biochemical indices of broiler finisher chickens fed graded levels of acidifier supplementation to LCPD are presented in Tables 2 and 3 respectively. The final body weight and BWG of the birds were significantly (p<0.05) higher in the groups fed acidifier-supplemented LCPD and control diet compared to the group fed LCPD. A lower (p<0.05) FCR was recorded among the groups fed acidifier supplemented LCPD and control diets than the birds fed LCPD without acidifier supplementation. A higher (p<0.05) total protein was recorded in birds fed 3% acidifier LCPD which was similar to LCPD and 1% acidifier LCPD diets compared to those on control diet and LCPD with 2% acidifier supplementation. Birds fed 3% acidifier LCPD showed higher (p<0.05) mean values of globulin concentration than birds fed control diet and 1% and 2% acidifier LCPDs. A significant decrease (p<0.05) in serum urea nitrogen was recorded in birds fed 1% and 3% acidifier supplemented LCPD compare to those fed control diet and LCPD group. The poor performance of birds fed LCPD in the present study is in line with previous reports that recorded decreased BWG and higher FCR (Dean *et al*., 2006; Awad *et al*., 2016; Chrystal *et al*., 2020). These authors attributed the reduced performance to insufficient levels of essential and non-essential AA in a diet containing low CP levels. On the other hand, the addition of acidifier supplements had a positive influence on performance, which is in agreement with numerous field trials conducted by previous researchers (Gao *et al*., 2021; Xue *et al*., 2023; Waghmare *et al*., 2025). Therefore, feeding management with reduced dietary protein combined with supplemental acidifier improved the efficiency of feed utilization and growth, as characterized by low FCR in the current investigation. This improvement in performance by acidifier could be explained by its role in increasing the efficiency of amino acid utilization by improving the digestibility due to the improvement of the intestinal microflora balance (Mahfudz *et al*., 2020; Kop Bozbay *et al*., 2024; Waghmare *et al*., 2025). In addition, dietary acidification can positively affect growth performance through acidity reduction of the diet and gut, eliminating harmful microbes that are sensitive to low pH or selectively enhancing Lactobacillus (Heidari *et al*., 2018; Sedghi *et al*., 2024; Waghmare *et al*., 2025). Cost/kg gain decreased significantly with decreasing levels of acidifier supplemented LCPDs. This observation could be attributed to a reduction in cost per kilogram of feed with a decreased cost per unit of soybean meal in the

Table 2: Effect of graded levels of acidifier supplementation to low crude protein diet ofbroiler finisher chicken on growth performance

Treatment	Av. Initial weight, g	Av. Final weight, g	Av. BWG, g	Av. Feed intake, g	FCR	Feed cost/kg	Cost/kg gain
PC	829.17	1550.00[ab]	720.83[a]	1870.83	2.63[b]	531.39	383.05[a]
NC	820.83	1400.00[b]	579.17[b]	1924.17	3.42[a]	424.11	245.63[b]
NC+1% AF	825.00	1533.33[ab]	708.33[a]	1875.00	2.66[b]	426.12	301.84[b]
NC+2% AF	825.00	1608.33[a]	783.33[a]	1889.17	2.50[b]	428.13	335.37[b]
NC+3% AF	837.50	1558.33[ab]	720.83[a]	1944.17	2.70[b]	430.15	310.06[b]
SEM	5.20	29.20	29.384	14.92	0.14	---	15.89
p-values	0.915	0.023	0.028	0.499	0.027	---	0.057

[abc]Mean values in the same row with different letters are significantly different (P<0.05)

LCPDs. Thus, the results of this study provided an understanding that the combination of LCPD and supplemental acidifier plays an important role in both productive improvement and economic profitability (Mahfudz *et al.,* 2020; Gao *et al.,* 221). The STP and SUN are regarded to be an important index of AA utilization in broilers suggesting the extent of protein and amino acid metabolism (Donsbough *et al*., 2010). The increased STP and reduced SUN levels in broilers fed acidifier-supplemented LCPDs is an indication of increased protein digestibility and absorption leading to increased efficiency of AA utilization (Mahfudz *et al*., 2020; Xue *et al*., 2023). The increase in protein and AA utilization due to acidifier supplementation could be connected with the improvement of gastrointestinal ecology and morphology (Mahfudz *et al*., 2020; Gao, *et al*., 2021).

Table 3: Effect of graded levels of acidifier supplementation to low crude protein diet ofbroiler finisher chicken on blood chemistry

Treatment	Total Protein g/dL	Albumin g/dL	Globulin g/dL	Albumin/Globulin Ratio, g/dL	Urea Nitrogen g/dL
PC	6.20[b]	3.06	3.14[b]	0.98	101.57[ab]
NC	7.12[ab]	3.94	3.18[b]	1.25	137.34[a]
NC+1% AF	6.87[ab]	3.56	3.31[b]	1.08	70.16[c]
NC+2% AF	6.41[b]	3.49	2.92[b]	1.41	91.51[b]
NC+3% AF	7.99[a]	2.92	5.07[a]	0.59	83.60[bc]
SEM	0.20	0.15	0.25	0.11	7.71
P-values	0.009	0.163	0.009	0.186	0.032

[abc]Mean values in the same row with different letters are significantly different (P<0.05)

CONCLUSION AND RECOMMENDATION

Reducing dietary CP from 20 to 16 % in broiler finisher chicken with acidifier supplementation up to 300 mg/kg positively influenced their performance and blood biochemical indices at lower cost/kg gain.

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