

Effects of Amino Acid Supplementation in Low-Crude Protein Diets on Growth Performance, Footpad Health, and Economics of Hubbard Broilers Raised in a Deep-Litter System

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Abstract— This study evaluated the effects of reduced crude protein (CP) diets supplemented with amino acids on the growth performance and profitability of Hubbard colored broilers. Three isocaloric finisher rations were formulated with 19%, 17%, and 15% CP, with the CP-reduced diets supplemented with methionine, lysine, threonine, and tryptophan. A total of 120 broilers were randomly assigned to these three treatments with four replicates each. Results showed significant differences ($p < 0.05$) in final weight, total weight gain, and average daily gain. Broilers fed reduced CP diets (17% and 15%) exhibited superior growth performance compared to those on the 19% CP control. Furthermore, reduced CP treatments significantly decreased the incidence of footpad dermatitis and increased net profit and return on investment. These findings suggest that lowering CP levels with amino acid supplementation offers a cost-effective and environmentally sustainable strategy for broiler production.

Keywords— Crude Protein, Amino Acids, Hubbard Broilers, Growth Performance, Footpad Dermatitis, Economics.

I. INTRODUCTION

In the Philippines, poultry production, particularly chicken meat production, continues to grow due to its demand and lower price in the market. The demand for poultry products brought its success in the animal enterprise due to lack of supply and higher cost of pork brought on by the African Swine Fever (ASF) outbreak (Acosta, 2022). In the Cordillera region, backyard raising for livestock and poultry is practiced for consumption and for additional income. Rearing poultry is more likely to increase through the years due to its lower cost in financing compared to livestock such as pigs and ruminants.

Recent industry trends emphasize improving animal welfare, mitigating environmental pollution, and reducing production costs, primarily those associated with feed. The product of metabolism in poultry such as undigested dietary protein and uric acid is excreted into the environment that could become a source of ammonia (Nahm, 2003). According to Poultry World (2019), unused amino acids are changed into nitrogen which results in higher ammonia levels in the poultry house that affects the animal as well as the workers. Generally, production of 1 kg chicken meat generates 1.1 kg CO₂ equivalents and it has also been predicted that it will contribute 7.1% of greenhouse gases (Fiola, 2008).

Current research focuses on mitigating the environmental impact of livestock production, specifically the emission of greenhouse gases. Studies demonstrate that developing reduced-crude protein (CP) diets supplemented with crystalline (non-bound) amino acids significantly lowers gas emissions (Chrystal et al., 2020; Meda et al., 2019). Furthermore, Applegate (2008) identified CP reduction through amino acid supplementation as the most effective strategy for decreasing nitrogen excretion in poultry waste. While formulating reduced-CP diets is an established concept, the modern availability of synthetic amino acids now allows for a substantial reduction in both dietary CP and reliance on soybean meal.

The determination of ideal dietary CP levels has been a subject of debate since the recognition that protein requirements are essentially a requirement for a specific profile of amino acids (Pesti, 2009). Beyond nutritional balance, manipulating these

levels serves as an environmental tool; Ferguson et al. (1998) asserted that reducing CP during the grower and finisher phases, supplemented with synthetic amino acids, is the most cost-effective method for controlling ammonia (NH₃) emissions.

High costs of corn and soybean meal often drive up feed prices, prompting producers to seek cost-reduction strategies that maintain flock performance. While Son et al. (2024) observed that reducing dietary CP lowered total feed costs without altering net profit, performance results vary. Consequently, this study aims to validate the performance of Hubbard broilers reared on deep litter when fed CP-reduced diets.

II. MATERIALS AND METHODS

2.1 Pre-experimental Phase:

2.1.1 Preparation of Brooding Pens:

One week prior to chick arrival, the experimental area was cleaned and disinfected. Broilers were housed in a corrugated GI-roofed pen with 4-inch deep rice hull litter and brooding paper. The area was pre-heated for 12 hours using six 100-watt incandescent bulbs, which served as the primary heat and light source throughout the brooding period.

2.1.2 Brooding Management:

During the entire brooding period, ventilation, lighting, and temperature were closely monitored to ensure the overall health of the brood. The chicks were fed a commercial booster diet from day 1 to 17 and provided potable water ad libitum.

2.2 Experimental Phase:

2.2.1 Experimental Design:

At 22 days of age, 120 Hubbard colored broilers (60 males and 60 females) were selected from an initial flock of 200 and assigned to three dietary treatments using a Randomized Complete Block Design (RCBD). Each treatment consisted of four replicates, with 10 birds per replicate (5 males and 5 females). The experimental diets were:

- **T0** - (Control) at 19% CP
- **T1** - 17% CP with amino acid (AA) supplementation
- **T2** - 15% CP with amino acid (AA) supplementation

Data were analyzed using the Univariate Analysis of Variance (UNIANOVA) for Randomized Complete Block Design (RCBD) using Statistical Analysis System. Differences in treatment means were compared using the Duncan Multiple Range Test (DMRT) at 5% level of significance.

2.2.2 Experimental Area:

A 4-inch deep litter using rice hull was used in rearing the birds until the termination of the study. Each pen had a dimension of 1.02 m × 2.57 m, using plastic slats as pen dividers.

2.2.3 Preparation of Feeds:

The experimental finisher rations (Table 1) were formulated according to the Hubbard Broiler Management Manual (WinMix Soft, 2014) specifications for birds with a 2.0 kg target slaughter weight. While the manual recommends a crude protein (CP) range of 19–21% and a metabolizable energy (ME) of 3,150–3,200 kcal/kg, this study utilized the minimum requirements (19% CP) as the baseline for the control diet. Across all treatments, 3,150 kcal/kg ME was used to formulate isocaloric diets.

Major ingredients (soybean meal, corn, and rice bran) were analyzed at the Charoen Pokphand Foods Philippines Corporation Feed Laboratory to ensure precise formulation of target CP levels. Diets were prepared in 20-kg batches, with ingredients weighed via digital scale. Micro-ingredients were premixed separately, then incorporated into macro-ingredients that had been mechanically mixed for 5 minutes, followed by an additional 5 minutes of mixing. Coconut oil was subsequently added, and the complete diet was mixed for 10 minutes to ensure homogeneity.

TABLE 1
FEED INGREDIENTS AND NUTRIENT COMPOSITION OF FINISHER DIET

Ingredients	19% CP	17% CP + AA	15% CP + AA
Yellow Corn	58	58	58
Soybean Meal	28.802	24.165	19.483
Rice Bran	5	5	5
Coconut Oil	4.605	5.8	7
Limestone	0.913	0.948	0.983
MDCP	1.74	1.791	1.843
Salt	0.3	0.3	0.3
Vitamin Premix	0.03	0.03	0.03
Mineral Premix	0.1	0.1	0.1
Refined Sand	0.51	3.517	6.557
Amino Acids			
Methionine	-	0.123	0.165
Lysine	-	0.161	0.345
Tryptophan	-	0.039	0.07
Threonine	-	0.026	0.124
Nutrient Composition (Calculated)			
Metabolizable Energy (kcal) *	3,150.08	3,150.42	3,150.13
Crude Protein **	19%	17%	15%

*ME is computed values based on book values by PHILSAN.

**CP is computed values based on the analysis of individual raw ingredients.

2.2.4 General Care and Management:

Experimental birds were managed uniformly, differing only in their respective dietary treatments. The pens were equipped with sanitized feeders and drinkers; water was refreshed twice daily, and litter was turned three times weekly to maintain quality. Feed was provided twice daily (8:00–9:00 AM and 3:00–4:00 PM) at an amount that is 20 g/bird above the previous day's intake to ensure ad libitum access, with refusals weighed every morning. Individual body weights were recorded weekly (± 1 g), and Newcastle disease vaccinations were administered intraocularly at weeks 2 and 4.

III. RESULTS AND DISCUSSION

3.1 Body Weight:

The initial (22 d) and final (50 d) body weights are presented in Table 2. Initial body weights did not differ significantly among treatments (709.10–716.03 g; $p > 0.05$), indicating uniformity of the experimental birds at the start of the trial. Thus, subsequent differences in final body weight can be attributed to dietary treatments rather than baseline variation.

At 50 days, significant differences ($p < 0.05$) were observed in growth performance. Broilers on the 15% CP + AA and 17% CP + AA diets achieved significantly higher body weights (2,220.58 g and 2,199.18 g, respectively) compared to those on the unsupplemented 19% CP control (1,966.65 g). These results indicate that amino acid supplementation effectively compensated for reduced dietary protein, thereby sustaining or enhancing growth. However, it is important to note that final body weights across all treatments remained below the Hubbard JA787 (2023) breed standard of 2,526 g for birds at 50 days of age.

TABLE 2
INITIAL AND FINAL BODY WEIGHTS (g) OF HUBBARD BROILERS FED CRUDE PROTEIN-REDUCED DIETS
SUPPLEMENTED WITH ESSENTIAL AMINO ACIDS

Treatment	Body Weight (G)		Final
	Initial		
19% CP	709.1		1,966.65 ^b
17% CP + AA	716.03		2,199.18 ^a
15% CP + AA	715.43		2,220.58 ^a

Means with different superscripts differ significantly ($p < 0.05$, LSD).

These results corroborate existing literature suggesting that high crude protein (CP) levels are unnecessary provided that the essential amino acid profile is precisely balanced. Sterling et al. (2005) demonstrated that broilers achieve optimal performance on reduced-CP diets when supplemented with limiting amino acids such as lysine, methionine, and threonine.

The reduced final weight observed in the 19% CP group may be attributed to the metabolic inefficiency of utilizing excess dietary protein. Excessive protein intake accelerates deamination, resulting in elevated nitrogen excretion and a significant metabolic cost to the bird (Kidd et al., 2004). This physiological process diverts dietary energy away from tissue accretion toward the detoxification and elimination of nitrogenous waste, potentially explaining the stunted growth in broilers fed the highest CP ration.

These results corroborate the findings of van Harn et al. (2019) and Belloir et al. (2019), who observed that moderate CP reductions do not compromise final body weight when diets are formulated based on digestible amino acid requirements. Similar performance stability in reduced-CP diets has been attributed to the supplementation of essential amino acids, specifically methionine and lysine (Khan et al., 2011). This aligns with earlier evidence from Corzo et al. (2006), which demonstrated that lysine supplementation enhances both live weight and feed conversion. Collectively, as emphasized by Baxter et al. (2020) and Lisnahan et al. (2017), these studies highlight that optimal growth is a function of a balanced amino acid profile rather than a high crude protein concentration.

Weekly body weight monitoring from placement through week 3 (Figure 1) indicated a consistent growth trajectory across all treatments. Notably, broilers on reduced-CP diets exhibited superior body weight compared to the 19% CP control. These results reinforce the principle that absolute crude protein levels are not the primary drivers of growth performance. Instead, precise formulation based on a balanced profile of digestible amino acids appears more critical for optimizing nutrient utilization and supporting early development.

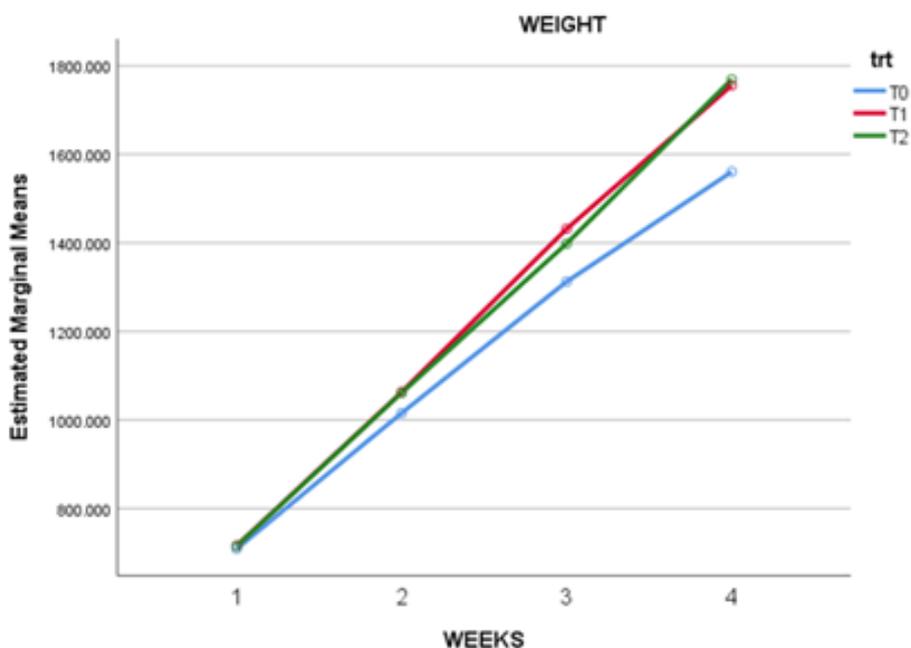


FIGURE 1: Weekly weight of broilers fed (g)

3.2 Gain in Weight:

Total weight gain (TWG) and average daily gain (ADG) for the experimental period are presented in Table 3. Broilers fed the 15% CP + AA and 17% CP + AA diets achieved significantly higher ($p < 0.05$) TWG (1,505.15 g and 1,483.16 g, respectively) than those on the 19% CP control (1,257.55 g). Similarly, the ADG for the 15% and 17% CP treatments (53.76 g and 52.97 g) surpassed the 44.91 g recorded for the control group. These findings demonstrate that dietary CP reduction does not compromise growth performance, provided it is accompanied by precise amino acid supplementation.

The present findings are consistent with those reported by van Harn et al. (2019) and Belloir et al. (2019), who demonstrated that broilers fed reduced crude protein diets supplemented with essential amino acids maintained or improved total weight gain and average daily gain compared with birds fed higher-protein diets.

TABLE 3
TOTAL WEIGHT GAIN (TWG) AND AVERAGE DAILY GAIN (ADG) OF HUBBARD BROILERS FED CRUDE PROTEIN-REDUCED DIETS SUPPLEMENTED WITH ESSENTIAL AMINO ACIDS

Treatment	TWG (g)	ADG (g)
19% CP	1,257.55 ^b	44.91 ^b
17% CP + AA	1,483.16 ^a	52.97 ^a
15% CP + AA	1,505.15 ^a	53.76 ^a

Means with different superscripts differ significantly ($p < 0.05$, LSD).

The weekly body weight gain (BWG) and average daily gain (ADG) are illustrated in Figures 2a and 2b. Broilers fed the 15% CP + AA diet exhibited a consistent upward trend, demonstrating the efficacy of amino acid supplementation. Conversely, a sharp decline in BWG was observed in the 19% CP and 17% CP + AA groups during week 3, primarily due to a temporary reduction in feed intake over a two-day period. However, these groups demonstrated a robust recovery by week 4, likely reflecting compensatory growth triggered by increased feed consumption. The nearly identical trends in total weight gain and ADG indicate a direct correlation between these two performance metrics.

The temporary decline in weight gain was likely an isolated occurrence unrelated to the dietary treatments, as only a single replicate per treatment was affected. No clinical signs of disease or adverse environmental factors were observed that could account for this localized decrease, as adjacent pens maintained normal performance. Despite the weight gain fluctuations in Treatment 1, broilers on reduced-CP diets consistently outperformed those in the 19% CP group. While partial molting was observed, there is insufficient evidence to definitively link this physiological process to the transient reduction in feed intake.

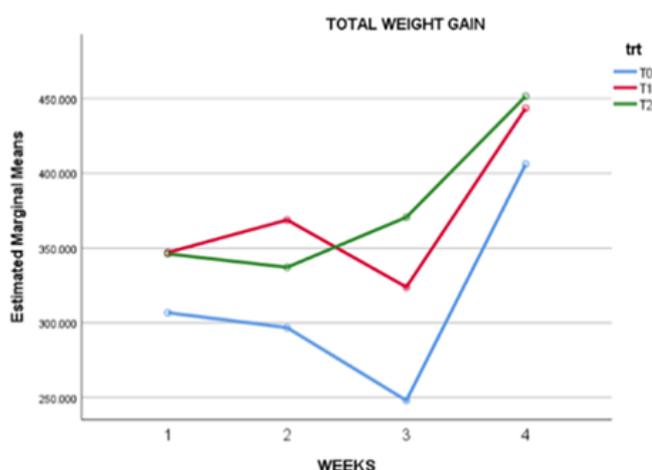


FIGURE 2a. Weekly total weight gain of Hubbard broilers

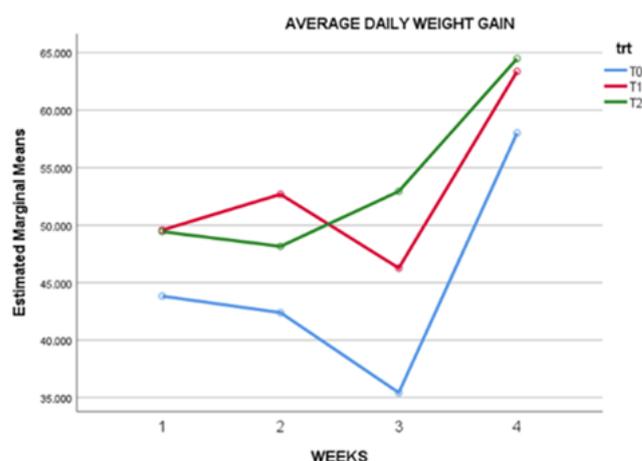


FIGURE 2b. Average daily gain in weight of Hubbard broilers

3.3 Feed Intake:

Total feed intake (TFI) and average daily feed intake (ADFI) are summarized in Table 4. No significant differences ($p > 0.05$) were observed among treatments for either TFI or ADFI (as-fed and dry matter basis). However, broilers on the 15% CP + AA and 17% CP + AA diets exhibited numerically higher TFI and ADFI compared to the 19% CP control. These findings align with Songuine et al. (2025), who reported improved intake following methionine supplementation. Conversely, the poorer performance of the 19% CP group mirrors observations by Hossain et al. (2017), who attributed reduced growth in high-protein diets to impaired nutrient digestibility.

TABLE 4
AVERAGE DAILY FEED INTAKE (ADFI) AND TOTAL FEED INTAKE (TFI) OF HUBBARD BROILERS FED CRUDE PROTEIN-REDUCED DIETS SUPPLEMENTED WITH ESSENTIAL AMINO ACIDS (g)

Treatment	ADFI As Fed	ADFI DM	TFI As Fed
19% CP	121.17 ^a	105.10 ^b	3,392.63 ^a
17% CP + AA	126.33 ^a	110.42 ^{ab}	3,537.12 ^a
15% CP + AA	129.72 ^a	114.53 ^a	3,632.03 ^a

Means with different superscripts differ significantly ($p < 0.05$, LSD).

Figures 3a and 3b illustrate the weekly total feed intake and weekly average daily feed intake (ADFI) of broilers across dietary treatments. From the onset of the study, birds fed the 19% CP diet consistently exhibited lower weekly total feed intake and ADFI compared with those receiving reduced crude protein diets supplemented with amino acids. This pattern contributed to the lower cumulative feed intake observed in the 19% CP group over the entire experimental period. The results suggest that reducing dietary crude protein does not adversely affect feed intake when essential amino acids are supplemented to maintain nutritional adequacy.

A temporary decline in feed intake was observed in one replicate each of Treatment 0 and Treatment 1. This reduction may have been associated with environmental fluctuations, particularly elevated daytime temperatures followed by afternoon rainfall, which could have influenced feeding behavior. No clinical signs of disease were observed during this period, and feed intake returned to normal levels in subsequent days. The recovery in intake supports the assumption that the transient reduction was likely due to short-term environmental stress rather than treatment effects or health-related factors.

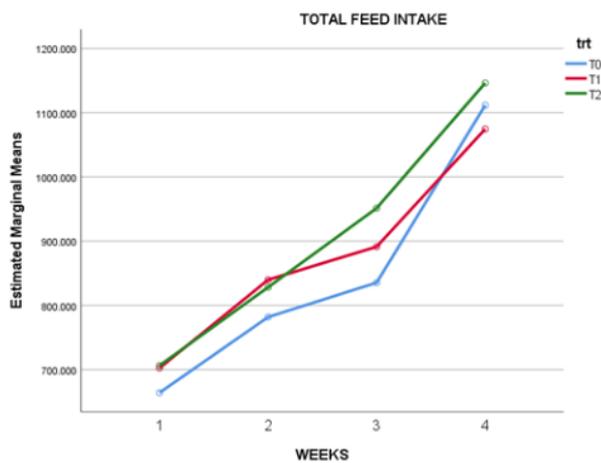


FIGURE 3a. Weekly total feed intake (as-fed basis) of Hubbard broilers

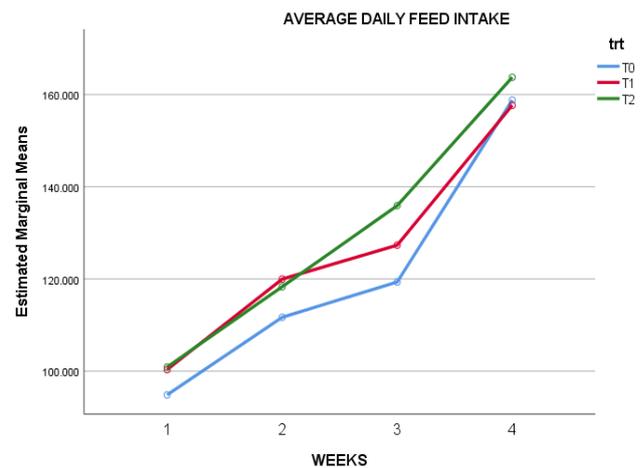


FIGURE 3b. Weekly average daily feed intake (as-fed basis) of Hubbard broilers

3.4 Feed Efficiency:

Table 5 presents the feed conversion ratio (FCR) and gain-to-feed (G:F) ratio of broilers across treatments. A significant difference ($p < 0.05$) was observed among dietary treatments for FCR, expressed on both as-fed and dry matter bases. Despite the reduction in dietary crude protein, broilers fed the amino acid-supplemented reduced-CP diets exhibited improved FCR and G:F values compared with those fed the 19% CP diet. These results indicate that when limiting amino acids are adequately supplied, reductions in crude protein do not compromise feed efficiency. Notably, the FCR values obtained in the present study were lower (i.e., better) than the average FCR (1.63) reported for standard Hubbard JA787 broilers from 23 to 50 days of age.

The findings of this study are consistent with those of van Harn et al. (2019) and Belloir et al. (2017), who reported that reducing dietary crude protein by 2% to 4% did not adversely affect feed conversion when diets were balanced with essential amino acids. These results support the concept that feed efficiency is primarily determined by amino acid balance rather than crude protein concentration per se. The higher FCR observed in broilers fed the 19% CP diet may be associated with less efficient nutrient utilization, potentially linked to impaired intestinal function. van Harn et al. (2019) suggested that high-protein diets may negatively influence gut health and performance. Similarly, Liu et al. (2017), Apajalahti and Vienola (2016), and Qaisrani et al. (2015) reported that excessive dietary protein can increase undigested protein flow to the hindgut, promoting microbial fermentation and the production of harmful metabolites, which may compromise intestinal health and growth performance. Reducing crude protein levels may therefore decrease the production of toxic protein fermentation products in the ceca, contributing to improved nutrient utilization.

Although intestinal morphological and histological parameters were not evaluated in the present study, previous research provides supporting evidence. Buwjoom et al. (2010) reported improvements in intestinal characteristics following dietary protein reduction. Furthermore, Macelline et al. (2020) demonstrated that broilers fed low-protein diets supplemented with amino acids exhibited upregulation of tight junction-related genes (e.g., ZO-1 and claudin-1), which are essential for

maintaining intestinal barrier integrity. Wang and Peng (2008) emphasized that the efficiency of dietary protein utilization is closely associated with gastrointestinal tract structure and function, underscoring the critical role of intestinal health in nutrient absorption and feed efficiency.

TABLE 5
FEED CONVERSION RATIO (FCR) AND GAIN-TO-FEED (G:F) RATIO OF HUBBARD BROILERS FED CRUDE PROTEIN-REDUCED DIETS SUPPLEMENTED WITH ESSENTIAL AMINO ACIDS

Treatment	FCR As Fed	FCR DM	Gain to Feed Ratio
19% CP	2.80 ^a	2.43 ^a	0.37 ^b
17% CP + AA	2.41 ^b	2.11 ^b	0.43 ^a
15% CP + AA	2.41 ^b	2.13 ^b	0.42 ^a

Means with different superscripts differ significantly (p < 0.05, LSD).

Figures 4a and 4b illustrate the weekly feed conversion ratio (FCR) and gain-to-feed (G:F) ratio. Throughout the four-week experimental period, birds receiving the control diet (Treatment 0; 19% CP) consistently exhibited a higher FCR compared to those on reduced crude protein (CP) diets (p < 0.05). A notable performance fluctuation was observed during Week 3, where Treatments 0 and 1 showed a sharp increase in FCR and a corresponding drastic decline in G:F. This shift was attributed to a transient reduction in voluntary feed intake, which limited the nutrient availability for weight gain during this phase.

In contrast, Treatment 2 maintained a linear, gradual increase in FCR and a steady decline in G:F efficiency. This progression aligns with the physiological maturation of the birds, as metabolic partitioning shifts from lean tissue deposition toward maintenance and fat accretion as age increases. Overall, the data suggest that reducing CP levels improved feed utilization efficiency, with Treatment 2 demonstrating the most stable growth trajectory and superior nutrient conversion compared to the 19% CP control.

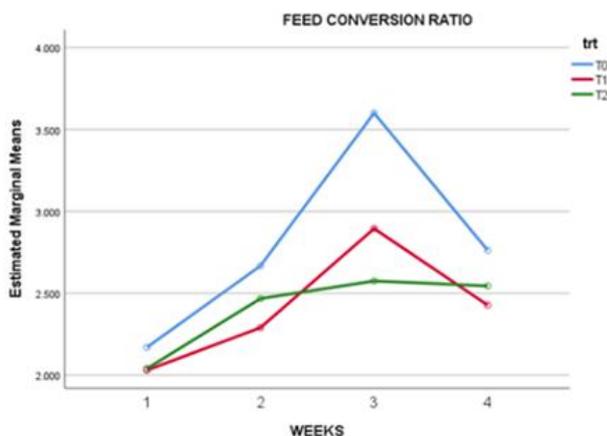


FIGURE 4a. Effects of dietary crude protein reduction and amino acid supplementation on feed conversion ratio (FCR) of Hubbard broilers over a 4-week period

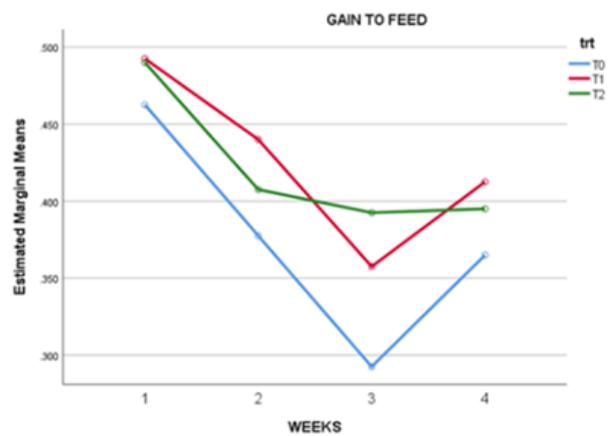


FIGURE 4b. Effects of dietary crude protein reduction and amino acid supplementation on gain-to-feed (G:F) ratio of Hubbard broilers over a 4-week period

3.5 Mortality:

Mortality data are summarized in Table 6. Overall survival was high across all groups, with a single mortality event (2.50%) recorded in the 17% CP + AA treatment group. Based on necropsy findings and environmental conditions, this mortality was not attributed to the dietary treatments. The bird exhibited clinical signs consistent with acute heat exhaustion, characterized by pallor of the pectoralis major (Plate 1), a common indicator of heat-induced myopathy in broilers (Srivastava, 2022). These findings align with the high ambient temperatures recorded during the summer rearing period. Consequently, the isolated loss was classified as an environmental rather than a nutritional casualty.

TABLE 6
CUMULATIVE MORTALITY RATE (%) OF HUBBARD BROILERS ACROSS DIETARY TREATMENTS

Treatment	Mortality	Percentage (%)
	Number	
19% CP	0	0
17% CP + AA	1	2.5
15% CP + AA	0	0

This data was not subjected to statistical analysis.



PLATE 1: Gross pathological changes in a 17% CP + AA bird; the pale coloration of the breast tissue suggests heat-related mortality rather than nutritional deficiency (cf. Srivastava, 2022)

3.6 Footpad Dermatitis:

The incidence and severity of footpad dermatitis (FPD) during Weeks 3 and 4 are summarized in Table 7, based on the scoring system established by Nagaraj et al. (2007). At Week 3, birds receiving the 15% and 17% CP + AA diets exhibited Score 0 (no lesions), whereas the 19% CP control group showed a 10% incidence of Score 1 lesions. By Week 4, although FPD was observed across all treatments, the severity was inversely proportional to dietary CP levels: Score 1 incidence was highest in the 19% CP group (12.50%), followed by the 17% CP + AA (10.00%) and 15% CP + AA (2.50%) groups. Notably, no lesions reaching Score 2 were recorded during the experimental period.

These findings align with previous research indicating that reduced dietary protein intake significantly mitigates the risk of FPD (Son et al., 2024; van Harn et al., 2019). The reduction in FPD incidence in low-CP groups is likely mediated by a decrease in excess nitrogen excretion, which consequently lowers voluntary water intake (Alfonso-Avila et al., 2022). Lower water intake reduces excreta moisture and maintains litter friability, preventing the prolonged contact with wet substrate that triggers pododermatitis and hock burns (Swiatkiewicz et al., 2017). Additionally, consistent litter management, including maintaining adequate depth and periodic agitation, likely contributed to the low overall severity of lesions observed in this flock.

TABLE 7
INCIDENCE AND SEVERITY OF FOOTPAD DERMATITIS (%) IN HUBBARD BROILERS AT WEEK 3 AND WEEK 4

Treatment	Week 3			Week 4		
	0	1	2	0	1	2
19% CP	90	10	0	87.5	12.5	0
17% CP + AA	100	0	0	90	10	0
15% CP + AA	100	0	0	97.5	2.5	0

This data was not statistically analyzed.



PLATE 3a: Visual assessment of footpad health: normal intact skin (Score 0)



PLATE 3b: Visual assessment of footpad health: mild plantar pododermatitis (Score 1). Scoring based on the scale by Nagaraj et al. (2007)

3.7 Profitability:

3.7.1 Production Costs and Sales:

The economic performance of Hubbard broilers under different dietary CP levels is summarized in Table 8. The total cost of production increased as dietary CP was reduced, a trend primarily driven by the higher inclusion levels of crystalline amino acid supplements and associated labor costs. Consequently, these nutritional inputs directly elevated the cost of production per bird in the reduced CP treatment groups.

Net sales were calculated based on a prevailing farmgate price of ₱165.00/kg live weight. Despite the lower production costs in the control group (19% CP), this treatment yielded a negative net profit and profit per bird (-₱418.50 and -₱10.46, respectively), largely due to significantly lower final body weights. Conversely, birds receiving the 17% + AA and 15% CP + AA diets achieved positive economic margins. This indicates that the enhanced growth performance and higher market weights of birds on crude protein-reduced diets more than compensated for the increased feed costs, resulting in superior net profit, ROI, and profit per bird.

Break-even point (BEP) analysis further validated these results. To reach the BEP in the 19% CP group, a minimum of 48 birds was required. In contrast, the 17% + AA and 15% CP + AA groups exceeded their respective BEP thresholds by 9 and 7 birds, respectively, confirming the economic feasibility and profitability of utilizing amino acid-supplemented, reduced-CP diets in broiler production.

**TABLE 8
 INFLUENCE OF DIETARY CRUDE PROTEIN (CP) AND AMINO ACID (AA) LEVELS ON THE ECONOMIC EFFICIENCY OF BROILER PRODUCTION**

Parameters	Treatment		
	19% CP	17% CP + AA	15% CP + AA
Total Expenses (₱)	13,399.05	13,794.00	14,128.86
Total Sales (₱)	12,980.55	14,515.05	14,655.30
Net Profit (₱)	-418.5	721.05	526.44
Profit per Bird (₱)	-10.46	18.03	13.16
Cost of Production per Bird (₱)	334.98	344.85	353.22
Return on Investment (%)	-3.12	5.23	3.73
Breakeven Point	48	31	33

This data was not statistically analyzed.

IV. CONCLUSION

Reducing dietary crude protein (CP) by up to 4% (15% CP) with amino acid supplementation significantly enhances feed intake, final body weight, and average daily gain in Hubbard colored broilers. These improvements in growth parameters resulted in superior feed conversion ratios (FCR) and feed efficiency compared to the 19% CP control. Beyond performance, the reduced-CP diets notably decreased the incidence of footpad dermatitis, suggesting improved welfare and litter quality. While the inclusion of synthetic amino acids increased initial production costs, the 15% and 17% CP treatments yielded a higher net profit, return on investment (ROI), and profit per bird. Consequently, amino acid-supplemented, low-CP diets represent a physiologically superior and more profitable strategy for finisher broiler production.

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CONFLICT OF INTEREST

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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