THE QUEST Journal of Multidisciplinary Research and Development
ISSN 1908-3211 (Online) | ISSN 1908-322X (Print)
P-ISSN: 1908-322X and E-ISSN: 1908-3211
Vol. 4 No. 2 (2025)
Received: 08-11/ Revised: 09-29/ Accepted:12-18-2025
https://neust.journalintellect.com/quest

Evaluating Fermented Freshwater Crab Amino Acid as a Sustainable Drinking-Water Supplement for Broilers: Impacts on Growth Performance and Economic Return

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Abstract. This study evaluated the effects of fermented freshwater crab amino acid (FCAA) as an organic drinking-water supplement on the growth performance, carcass traits, giblet yield, and economic return of broiler chickens. Sixty straight-run day-old chicks were used in a completely randomized design with four treatments and three replications, with five birds per cage. The treatments were plain water, 10%, 15%, and 20% FCAA in drinking water, respectively. Growth performance was assessed using weight gain, feed consumption, water consumption, and feed efficiency, while carcass evaluation included dressing percentage, abdominal fat percentage, and giblet weights. Birds given 20% FCAA obtained the highest weight gain, feed consumption, water consumption, and gizzard weight, whereas birds given 15% FCAA showed the best numerical feed efficiency and the highest net income. Statistical analysis indicated significant differences in feed and water consumption, while weight gain, feed efficiency, dressing percentage, abdominal fat percentage, and giblet traits were not significantly different among treatments. The findings indicate that fermented freshwater crab amino acid can be used as a locally available broiler supplement, with 15% inclusion showing the most favorable economic return under the conditions of the study.

Keywords: **Broiler chicken; Drinking-water supplement; Fermented freshwater crab amino acid; Growth performance; Profitability**

1. Introduction

Broiler production is an important component of animal-source food systems and contributes substantially to the supply of high-quality protein for human nutrition (FAO, 2013; Philippine Statistics Authority, 2022). Broiler meat is widely valued because it is relatively affordable, rich in protein, and generally lower in fat than many red meats (FAO, 2013). Efficient broiler production therefore remains important to both food security and farm profitability.

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Feed is one of the largest cost items in poultry production, and feed availability strongly affects the performance and profitability of broiler enterprises. Because feed commonly accounts for the largest share of production cost, the search for alternative or locally available supplements remains a practical concern in broiler production systems (FAO, 2013). This has encouraged interest in non-conventional materials that may support bird performance without substantially increasing production cost.

Crab-derived materials have potential in this context because crabs and crab by-products contain nutritionally and functionally important components that have received attention for feed and poultry applications (Grinang et al., 2017; Vijayalingam and Rajesh, 2020). Chitosan and its derivatives have been discussed as possible antibacterial, antioxidant, immunomodulatory, and growth-promoting additives in broiler production, although responses vary by source, inclusion level, and experimental conditions (Sugiharto and Nuengjamnong, 2025). Studies on freshwater crabs also show that these organisms can contribute meaningful nutrient fractions and exhibit omnivorous feeding ecology, supporting their potential as biological resource materials (Williner et al., 2014). Freshwater crab amino acid prepared through fermentation may therefore provide a locally available supplement for broiler production under farm conditions.

This study was conducted to determine the efficacy of fermented freshwater crab amino acid (FCAA) as an organic drinking-water supplement in improving the growth performance and carcass yield of broiler chickens. Specifically, the study evaluated weight gain, feed consumption, water consumption, feed efficiency, dressing percentage, abdominal fat percentage, giblet weights, and economic return.

2. Methodology

Sixty straight-run day-old chicks were used in the experiment. The study followed a completely randomized design with four treatments and three replications, resulting in 12 cages with five birds per cage. All birds served as sources of data for growth performance, while representative birds at the end of the study were used for carcass and giblet evaluation.

The experimental housing and materials were prepared, cleaned, and disinfected before the start of the trial. Birds were brooded for up to 14 days

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using 50-watt electric bulbs as a heat source, with newspaper and rice hulls used as bedding materials. On the 15th day, the birds were transferred to the experimental cages and their initial weights were recorded. Commercial feeds were used throughout the study, and birds were managed under standard feeding, sanitation, vaccination, and daily cleaning protocols.

2.1 Dietary Treatments

Freshwater crabs were collected from Banay-banay River at Barangay Bantug, Gabaldon, Nueva Ecija. The crabs were washed, drained for five minutes, and crushed using a blender. The crushed crabs were placed in a plastic pail, mixed thoroughly with molasses, covered with a nylon screen and Manila paper, and allowed to ferment in a cool dark room for 15 days. After fermentation, the liquid was filtered and stored in a plastic container for use according to the dosage assigned to each treatment. The treatments were as follows: Treatment 1: Plain water; Treatment 2: 10% FCAA in drinking water; Treatment 3: 15% FCAA in drinking water; Treatment 4: 20% FCAA in drinking water.

2.2 Data gathered

The study measured average weight gain, water consumption, feed consumption, and feed efficiency to determine growth performance. Dressing percentage, abdominal fat percentage, average liver weight, average heart weight, and average gizzard weight were measured to determine carcass and giblet yield, while cost and return analysis was used to compute total expenses, gross sales, and net income. All data were analyzed using the Statistical Tool for Agricultural Research, Analysis of Variance, and Least Significant Difference test.

3. Results and Discussion

3.1. Growth performance

Average weight gain showed a numerical increase as the level of FCAA in drinking water increased. Birds in Treatment 4 produced the highest weight gain (1,229.40 g), whereas the control group recorded the lowest weight gain (1,012.13 g). The observed differences were not statistically significant, indicating that FCAA supplementation did not exert a

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significant effect on these growth variables under the conditions of the study.

Water consumption and feed consumption were significantly influenced by treatment. Treatment 4 registered the highest water intake (2,656.67 ml) and feed intake (2,768.60 g), while the control group had the lowest water intake (2,441.00 ml) and lower feed intake (2,017.13 g). The increased intake observed at the highest supplementation level may partly explain the higher numerical body weight and weight gain recorded in this treatment.

Feed efficiency did not differ significantly among treatments. However, Treatment 3 showed the most favorable numerical value at 2.12 kg feed per kg gain, followed by the control (2.32), Treatment 2 (2.33), and Treatment 4 (2.53). This suggests that the intermediate level of supplementation may have supported relatively better feed utilization, although the effect was not statistically significant.

Table 1. Growth performance of broilers supplemented with FCAA in drinking water.

Treatment	Weight gain, g^{ns}	Water consumption, mL*	Feed consumption, g,**	Feed efficiency ^{ns}
Treatment 1 – Plain water	1,012.13	2,441.00	2,017.13	2.32
Treatment 2 – 10% FCAA	1,097.60	2,570.40	2,031.40	2.33
Treatment 3 – 15% FCAA	1,153.10	2,529.67	2,105.66	2.12
Treatment 4 – 20% FCAA	1,229.40	2,656.67	2,768.60	2.53

*CV= 1.63% –highly significant;

**CV= 4.95% **–highly significant

3.2 Carcass traits and giblet yield

Dressing percentage was not significantly affected by FCAA supplementation. The control group obtained the highest dressing percentage (79.91%), followed by Treatment 3 (77.08%), Treatment 2

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(69.49%), and Treatment 4 (69.29%). These results indicate that the inclusion of FCAA in drinking water did not significantly improve carcass recovery.

Similarly, abdominal fat percentage did not vary significantly among treatments. Treatment 4 recorded the highest abdominal fat percentage (1.15%), while Treatment 3 had the lowest value (0.94%). The relatively narrow range of values suggests that supplementation did not materially influence fat deposition in broiler chickens.

The measured giblet traits, including liver, heart, and gizzard weights, were likewise not significantly affected by treatment. Treatment 3 had the highest liver weight (37 g) and heart weight (11 g), whereas Treatment 4 produced the highest gizzard weight (47 g). The absence of significant differences suggests that FCAA supplementation did not adversely affect the internal organs measured in the present study.

Table 2. Carcass and giblet traits of broiler chickens supplemented with FCAA in drinking water.[ns]

Treatment	Dressing percentage,%	Abdominal fat, %	Liver weight, g	Heart weight, g	Gizzard weight, g
Treatment 1 – Plain water	79.91	1.09	33.00	10.00	39.00
Treatment 2 – 10% FCAA	69.49	1.00	32.00	10.00	43.00
Treatment 3 – 15% FCAA	77.08	0.94	37.00	11.00	45.00
Treatment 4 – 20% FCAA	69.29	1.15	33.00	10.00	47.00

3.3 Economic return

Economic performance varied across treatments. Treatment 4 generated the highest gross sales (Php 3,190.75), followed by Treatment 3 (Php 3,003.75), Treatment 2 (Php 2,814.75), and the control (Php 2,625.75).

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However, Treatment 4 also incurred the highest total expenses (Php 2,447.85), which reduced its net return relative to Treatment 3.

Among the treatments, Treatment 3 yielded the highest net income (Php 900.75), followed by Treatment 4 (Php 742.90), Treatment 2 (Php 626.00), and the control (Php 537.41). These findings indicate that although the highest supplementation level produced the greatest gross sales, the intermediate level of 15% FCAA provided the most favorable economic return under the conditions of the study.

Table 3. Cost and return analysis of broiler chickens supplemented with FCAA in drinking water.

Item	Treatment 1	Treatment 2	Treatment 3	Treatment 4
Total expenses, Php	1,188.34	1,188.50	1,230.62	2,447.85
Total ending value of stock, Php	2,625.75	2,814.75	3,003.75	3,190.75
Net income, Php	537.41	626.00	900.75	742.90

4. Conclusions

Fermented freshwater crab amino acid (FCAA) supplementation in drinking water can be used as a locally available broiler supplement under the conditions of the study. Feed and water consumption differed significantly among treatments, while weight gain, feed efficiency, dressing percentage, abdominal fat percentage, and giblet traits were not significantly affected. Among the supplementation levels tested, 15% FCAA gave the highest net income and the most favorable practical return.

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