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Research Article

Mitigating Heat Stress in Broilers: Potential of Dietary L-Tryptophan Supplementation in Improving Carcass Yield and Sensory Attributes

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Abstract | Poultry productivity is negatively affected by heat stress in tropical regions such as the Philippines, where the average heat index is 39.84°C and is projected to increase by up to 4.10°C by the end of the 21st century. This environmental stress results in significant economic losses and adversely impacts the growth, immunity, and meat quality of broilers. Among the nutritional strategies employed to alleviate these negative effects, L-tryptophan an essential amino acid plays a critical role in protein synthesis and stress mitigation in poultry production. This experiment was conducted to determine the effects of L-tryptophan supplementation on carcass yield and sensory attributes of broiler chicken meat raised under heat stress conditions during a 38-day feeding trial. A total of 75 day-old broiler chickens were assigned in a Completely Randomized Design with five dietary treatments, each replicated three times. The dietary treatments were: T_1 (commercial feed, negative control), T_2 (homemade ration without L-tryptophan and antibiotics, positive control), T_3 (homemade ration + 0.18% L-tryptophan), T_4 (homemade ration + 0.20% L-tryptophan), and T_5 (homemade ration + 0.22% L-tryptophan). Results indicated that L-tryptophan supplementation significantly improved ($p < 0.05$) tenderness, juiciness, and aroma but showed no significant effect ($p > 0.05$) on taste, overall acceptability, dressing percentage, or cooking loss. Significant improvements ($p < 0.05$) were also observed in head and drumstick yields. In conclusion, supplementing broiler diets with 0.20% to 0.22% L-tryptophan under heat stress conditions enhanced sensory attributes without compromising carcass yield, suggesting its potential as a practical nutritional strategy for mitigating heat stress in broilers raised in hot climates.

Keywords | Meat cut- up, Dressed weight, Dressing percentage, Cooking loss, Meat quality

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INTRODUCTION

Broiler chickens are primarily raised for meat due to their rapid growth, efficient feed conversion, and cost-effectiveness. Poultry meat is also valued for its high protein content and relatively low cholesterol compared to red meat (Bromfield *et al*., 2021). As global demand for animal protein rises with population growth, efficient and sustainable poultry systems are increasingly essential (Tona, 2018). However, in tropical countries, the poultry industry faces constraints such as extreme temperatures and high stocking densities, which can impair broiler health and performance by triggering oxidative stress and abnormal physiological responses (Mottet and Tempio, 2017; Sifia et al., 2018). Heat-stressed birds often exhibit reduced feed intake, poor growth, lower egg and meat quality, and muscle deterioration particularly in breast and thigh cuts leading to significant economic losses (Shao *et al*., 2018; Nawab *et al*., 2018; Wasti *et al*., 2020; Shakeri et al., 2020; Zhang *et al*., 2022; Kim *et al*., 2023). Among these challenges, heat stress remains the most critical, given the ongoing rise in global temperatures.

In the Philippines, poultry farming plays a crucial role in ensuring food security, driven by rising per capita income, rapid urbanization, and increasing nutritional demands. In 2023, per capita poultry meat consumption reached 15.95 kilograms, while total domestic consumption stood at 1.934 million metric tons (MMT) (OECD-FAO, 2021). This is projected to rise by 9.60% to 2.12 MMT by 2025 (IndexMundi, 2025). By 2030, per capita consumption is expected to increase to 16.3 kilograms, with overall domestic demand reaching approximately 2.287 MMT (OECD-FAO, 2021; Ordinario, 2021). Such growth underscores the need to optimize poultry production systems. However, the elevated thermal index poses a growing threat to poultry production. The average national heat index currently stands at 39.84°C and is projected to increase by up to 4.10°C by the end of the 21st century (PAGASA, 2025), potentially undermining productivity and animal welfare in the poultry sector. Poultry perform optimally within 23.9 °C to 26.7 °C, but temperatures above 32 °C can trigger acute stress responses such as panting, wing spreading, and increased heart rate that reduce feed intake (Bell *et al*., 2002; Ahmad *et al*., 2022). Without appropriate mitigation strategies such as improved ventilation, cooling systems, or dietary interventions prolonged exposure to this environment may result in increased morbidity and mortality. Among the nutritional strategies used to alleviate heat stress, L-tryptophan, an essential amino acid, plays a critical role in protein synthesis and stress mitigation in poultry production.

L-Tryptophan (Tryp) is a limiting amino acid in broiler diets due to its low levels in typical corn–soybean meal formulations (Barua *et al*., 2021), necessitating dietary supplementation. Tryp plays a key role in stress modulation by influencing serotonin synthesis, which supports thermoregulation, immune function, feed intake, feed efficiency, and reduced rectal temperature under heat stress (Young, 2013; Steenbergen *et al*., 2016; Bai *et al*., 2017; Kałużna-Czaplińska *et al*., 2019; Fouad *et al*., 2021; Zhao *et al*., 2022). Supplementation has also been linked to improved meat quality, particularly in flavor and tenderness important sensory attributes for consumers (Zhao *et al*., 2020; Fouad *et al*., 2021). Additionally, serotonin and other Tryp metabolites may enhance muscle development and protein metabolism. However, some studies report inconsistent effects on meat quality parameters such as pH, tenderness, color, and water retention (Guzik, 2002), suggesting that benefits may vary. Therefore, this study aims to determine the effects of dietary L-Tryptophan supplementation on carcass yield and sensory attributes of broiler chicken meat raised under heat stress environment.

MATERIALS AND METHODS

Experimental design and treatment

The study was conducted in accordance with the Philippine National Standards for Good Animal Husbandry Practices, specifically addressing animal farming, health, and welfare (PNS/BAFPS, 2008). A total of seventy-five-day-old broiler chicks, regardless of sex, were used in the study. The chicks were randomly assigned to five dietary treatment groups, with each treatment replicated three times and five birds per replicate. The experiment followed a completely randomized design. The dietary treatments were as follows: T_1 served as the negative control and consisted of a commercial ration; T_2, the positive control, was a homemade ration (HMR) without L-tryptophan and synthetic antibiotic (SA); T_3: HMR with 0.18% L-tryptophan; T_4: HMR with 0.20% L-tryptophan; and T_5: HMR with 0.22% L-tryptophan. The negative control (T_1) used a commercial feed that typically includes essential amino acids and antibiotics, representing the standard industry diet. The positive control (T_2) consisted of a homemade ration without L-tryptophan and antibiotics, serving as a baseline to assess the specific effects of L-tryptophan supplementation against a simplified diet lacking these additives.

Housing and experimental management

One week prior to chick arrival, the facility including a 1m x 2m elevated colony-type brooder pen was thoroughly cleaned and disinfected. Day-old chicks were placed in the brooder pen with newspaper bedding, changed regularly to prevent manure buildup. Artificial heat was provided using two 50-watt bulbs during the 10-day brooding period, with chicks fed *ad libitum* on commercial chick booster mash. On day 11, chicks were moved to elevated grower cages (1 sq. ft. per bird) made from bamboo slats and mesh flooring. They were fed experimental rations from days 11–24, followed by a gradual transition from starter to finisher mash from days 25–38. Clean drinking water and consistent environmental care were maintained throughout (Minanga and Ampode, 2021). To induce heat stress, the broiler house was enclosed using repurposed tarpaulins to limit ventilation and restrict airflow. Additionally, artificial lighting was introduced to elevate the ambient temperature, simulating heat stress conditions.

The housing environment was monitored three times daily at 6:00 AM, 12:00 NN, and 6:00 PM using a digital hygrometer (Curi et al., 2024). The average recorded temperature (T) was 41.71°C with a relative humidity

(RH) of 32%. The average THI from day 11 to day 31 of the experiment was used to assess the effects of heat stress. The calculated Temperature-Humidity Index (THI) was 88.72, which falls within the severe heat stress range for broilers. The THI was calculated using the formula of Boonkum *et al.* (2025): THI= (1.8 × T+32) −(0.55−0.0055 × RH) × (1.8×T−26).

Preparation of homemade ration

Experimental rations were formulated based on the proximate analysis of feed ingredients and aligned with nutrient requirements from the Philippine Recommends for Livestock Feed Formulation (PCAARRD, 2000). Two feeding phases were used: a starter ration with 20% crude protein (CP) and a finisher ration with 18% CP. The homemade ration (HMR) consisted of ground yellow corn, rice bran D1, soybean meal, fish meal, copra meal, dicalcium phosphate, limestone, lysine HCl, DL-methionine, vitamin premix, salt, and vegetable oil. L-tryptophan was supplemented at varying levels (0.18%, 0.20%, and 0.22%) in the T_3, T_4, and T_5 groups, respectively, while T_1 and T_2 received no L-tryptophan supplementation. All feed ingredients were thoroughly mixed according to the computed formulation ratios to ensure uniform nutrient distribution. The rations were prepared in mash form and provided ad libitum. All experimental birds received isocaloric and isonitrogenous diets, ensuring that each treatment group was supplied with equal energy and protein levels. The calculated nutrient composition is presented in Table 1.

Table 1: Calculated nutrient composition of homemade starter and finisher rations.

Calculated analysis	Starter 11-24 days	Finisher 25-38 days
Crude Protein (%)	20.00	18.00
Metabolizable Energy (Kcal)	2848.91	2883.31
Avail Phosphorus	0.49	0.49
Calcium	0.87	0.99
Lysine	1.35	1.08
Methionine	0.45	0.45
Met+Cys	0.64	0.67
Vitamin Premix[1]	0.90	0.90

[1]Vit.Premix which has fine quality/texture each 500g contains dicalcium phosphate 97%, Vit. 150,000 units, Vit. D3 30,000 units, Vit. E 500 I.U., Potassium Iodine 100mg, Carrier q.s. ad 500mg, Manganese Sulfate 3,500mg, Ferrous Sulfate1,500mg, Copper Sulfate1,500mg, Cobaltous Sulfate 30mg, Zinc Sulfate 200mg.

Slaughtering procedure

At the end of the 38-day experimental period, all birds underwent a 12-hour fasting period with continued access to clean drinking water to allow for adequate gut clearance prior to slaughter (Wotton, 2005). A total of 15 birds were slaughtered, specifically those closest to the mean body weight per treatment per replication, to ensure consistency and minimize variability in carcass quality assessments. Selected birds were humanely slaughtered using the kosher method, involving a swift, deep incision across the throat to sever the carotid arteries and jugular veins (PNS, 2016). This facilitates rapid exsanguination, which is critical for maintaining meat quality and hygiene (Gregory and Grandin, 2007). Following bleeding, the birds were scalded in hot water at a standard temperature of 51–54°C for 2–3 minutes to loosen feathers for efficient plucking (Barbut, 2016). Carcasses were defeathered, eviscerated, and thoroughly washed before being chilled under standardized conditions to maintain carcass integrity and prevent microbial contamination.

Preparation of meat samples, trimming and portioning

After chilling, excess fat, skin, bones, and connective tissue were carefully trimmed from the carcasses to obtain high-quality meat suitable for evaluation. Breast portions were selected for analysis due to their tenderness and flavor, making them ideal for sensory and quality assessments (Oladele *et al.*, 2021). Each chicken breast was cut into 10 uniform cubes, with each portion weighing approximately 7 grams, ensuring consistency in sensory testing for taste and texture (Usman *et al.*, 2021). Standardized portioning was essential to minimize variability and ensure each sample accurately represented overall meat quality. All samples were prepared following proper food handling protocols to maintain safety and quality. Personnel involved in preparation, cooking, and serving wore gloves, face masks, hair nets, and lab. coats to reduce the risk of contamination. The entire process was carried out at the University Food Processing Center.

On the day of testing, raw chicken breast was prepared on a separate table from the cooking and serving areas to prevent cross-contamination from microbial hazards. Additionally, gloves were changed, and hands were thoroughly washed whenever transitioning between raw and cooked products. The oven was preheated to 200 °C for approximately 10 minutes, and meat samples were roasted at this temperature for 30 minutes. The chicken breasts were placed in aluminum trays without seasonings, and each sample was covered with aluminum foil to retain moisture during cooking (Toomer et al., 2019). Cooking loss was calculated using: (Initial weight – Final weight) / Initial weight × 100, where the initial weight is the meat sample before oven drying, and the final weight is after oven drying.

Preparation of the meat cut up

The dressed chicken was weighed before dissection and the chicken cuts including breast, thigh, wings, drumstick, back, head, neck, and feet were processed following the Philippine National Standards (PNS, 2019). The dressing percentage was measured by the weight of the dressed chicken over the final weight. The carcass yield was weighed using the electric digital weighing scale with a capacity of three decimal digit readings of 0.000 gram.

Composition of tasting panel and sensory evaluation

Sensory evaluations were conducted with 30 trained panelists, comprising 15 men and 15 women, all with prior experience in meat quality assessment. All panelists received instructions before and during the evaluation and met the following criteria: Non-smokers, non-alcohol consumers, without false teeth, and regular consumers of chicken meat. Each participant was provided with cooked breast meat samples, served on plates labeled with a three-digit blind code to minimize bias. Distilled water was provided for palate cleansing before and after tasting each sample to remove residual flavors, neutralize the palate, eliminate impurities, and reset the taste buds.

The cooked breast samples were evaluated for aroma, taste, texture, juiciness, and overall acceptability. A five-point categorical hedonic scale (1= dislike extremely, 2= dislike moderately, 3= neither like nor dislike, 4= like moderately, 5= like extremely) was used to rate each parameter (Semjon *et al*., 2020). Tenderness refers to the ease of chewing, taste to flavor perception, aroma to the pleasant smell, juiciness to moisture content, and overall acceptability to overall consumer satisfaction.

Statistical analysis

The data collected were subjected to one-way analysis of variance (ANOVA), and treatment means were compared using Tukey's Honest Significant Difference (HSD) test. Statistical analyses were performed using the Statistical Tool for Agricultural Research (STAR). Differences were considered statistically significant at $p < 0.05$.

RESULTS AND DISCUSSION

Carcass yield

The supplementation of graded levels of L-tryptophan significantly affected the dressed weight of broiler chickens raised under heat stress ($p = 0.034$; Table 2). Among treatments, broilers fed 0.20% L-tryptophan (T_4) had the highest dressed weight (960.00 g), followed closely by those in T_5 (0.22%), T_3 (0.18%), and the control group (T_1). The lowest dressed weight was recorded in T_2, which received a homemade ration without tryptophan supplementation. These results suggest that L-tryptophan supplementation may enhance dressed weight under heat stress, possibly due to its role in modulating serotonin synthesis and improving feed intake, stress tolerance, and protein metabolism (Young, 2013; Fouad *et al*., 2021; Zhao *et al*., 2022). Conversely, Hsia *et al*. (2005) observed no improvement in dressed weight with tryptophan alone, underscoring that the effectiveness of supplementation may depend on the overall dietary profile.

Although the dressing percentage did not differ significantly among treatments (p= 0.610), noticeable numerical variations were observed. The highest value was recorded in T_4 (73.86%), followed by T_3 (72.84%) and T_5 (71.60%), while the control groups, T_1 and T_2, had the lowest percentages. Dressing percentage in poultry refers to the proportion of the live body weight that results in edible meat and is a key indicator of carcass efficiency and body composition. It reflects the balance between muscle mass, fat content, and the weight of non-carcass components such as internal organs and the gastrointestinal tract (Lage *et al*., 2012). This observation supports earlier findings by Kerr *et al*. (2005) and Liu *et al*. (2015), who reported improved carcass yield following tryptophan supplementation,

Table 2: Final weight, dressed weight, dressing percentage, and cooking loss of broiler chicken supplemented with L tryptophan raised under heat stress environment.

Parameters	Treatments					CV	P-value
	T_1	T_2	T_3	T_4	T_5		
Final Weight, kg	1309.33^{ab}	1170.00^{c}	1292.00^{b}	1300^{ab}	1337^{a}	1.77	0.000**
Dressed Weight, kg	917.33^{b}	816.33^{b}	940.33^{a}	960^{a}	956.57^{a}	5.58	0.033*
Dressing Percentage, %	68.39	69.77	72.84	73.86	71.60	6.47	0.610^{ns}
Cooking Loss, %	11.90	13.33	10.95	10. 95	10.00	11.65	0.093^{ns}

CV: Coefficient of variation; ^{ab} superscript letters within row showed significant difference at p<0.05; ^{ns}not significant (p>0.05); *significantly different (P<0.05); **highly significantly different (P<0.01); T_1: Commercial Ration (Negative Control); T_2: HMR (home made ration) without L-tryp and SA (Synthetic antibiotic); T_3: HMR + .18% L-tryp; T_4: HMR + .20% L-tryp; T_5: HMR + .22% L-Tryp

Table 3: Meat cut-up parts as a percentage (%) of the final weight of broiler supplemented with L tryptophan raised under chronic heat stress environment.

Parameters	Treatments					CV	P-value
	T_1	T_2	T_3	T_4	T_5		
Head	4.33^{c}	5.47a	4.62^{bc}	5.05^{ab}	4.88^{abc}	6.90	0.018^{*}
Neck	4.79	5.66	4.92	5.26	5.38	15.22	0.673^{ns}
Feet	5.49	5.35	5.15	5.17	5.59	7.69	0.625^{ns}
Wings	10.25	10.84	10.86	11.45	12.51	10.73	0.266^{ns}
Thigh	10.72	11.51	11.60	12.56	12.71	10.12	0.299^{ns}
Drumsticks	7.87^{c}	9.00^{ab}	8.51^{bc}	9.52^{ab}	9.60^{a}	6.25	0.017^{*}
Breast	25.47	25.24	26.12	26.67	28.10	8.79	0.590^{ns}

CV: Coefficient of variation; ^{abc} superscript letters within row showed significant difference at p<0.05; ^{ns}not significant (p>0.05); *significantly different (P<0.05); T_1: Commercial Ration (Negative Control); T_2: HMR without L-tryp and SA; T_3: HMR + .18% L-tryp; T_4: HMR + .20% L-tryp; T_5: HMR + .22% L-Tryp

attributed to increased muscle development and reduced fat deposition. Similarly, Xie *et al.* (2024) emphasized the synergistic role of dietary protein and tryptophan in enhancing carcass characteristics. These results suggest that L-tryptophan may contribute to improved carcass yield under heat stress conditions by promoting muscle accretion and enhancing metabolic efficiency. Therefore, while the differences were not statistically significant, the consistent numerical trend supports a biologically meaningful effect that warrants further investigation with larger sample sizes or under different environmental conditions.

Cooking loss

The cooking loss was not significantly affected by L-tryptophan supplementation (p=0.093); however, the numerical trend indicates a potential improvement in water-holding capacity. The lowest cooking loss was noted in T_5 (10.00%), followed by T_3 and T_4 (both 10.95%), while the highest was in T_2 (13.33%). Reduced cooking loss in the tryptophan-supplemented groups (T_3–T_5) may reflect improved meat quality through better moisture retention (Zhao *et al.*, 2020; Bello *et al.*, 2018). Improved water-holding capacity contributes to enhanced juiciness and tenderness important sensory attributes for consumer preference and marketability. While, Guzik (2002) reported inconsistent results regarding meat quality improvements with tryptophan, the observed numerical trends in this study suggest potential for optimization with correct dietary formulation. This implies that L-tryptophan supplementation in broiler diets under heat stress conditions positively influenced dressed weight and showed promising trends in dressing percentage and cooking loss, supporting its potential role in enhancing broiler performance and meat quality in challenging environments.

Meat cut-up yield

L-tryptophan supplementation under heat stress conditions resulted in significant differences (p<0.05) in the meat cut-up yield of broiler chickens (Table 3). Specifically, the yields of the head and drumstick parts varied significantly among treatment groups, while no significant differences were observed in the neck, feet, wings, thigh, and breast parts (p>0.05). These findings suggest that L-tryptophan may selectively influence the development of certain body parts under thermal stress. The increase in drumstick yield aligns with previous reports by Khatun *et al.* (2020), who found that L-tryptophan enhances carcass yield through its role in promoting muscle protein synthesis and reducing fat deposition. Additionally, Khatun *et al.* (2020) noted that higher dietary tryptophan levels significantly improved growth performance, feed efficiency, and profitability in broiler production. However, outcomes remain somewhat variable across studies. For instance, Hsia *et al.* (2005) reported that the effects of L-tryptophan supplementation on meat yield can depend on the specific dosage and anatomical site measured. These discrepancies may reflect differences in experimental design, genetic strain, or the severity of heat stress conditions.

Sensory attributes

The effect of L-tryptophan supplementation on the sensory characteristics of broiler meat under heat stress was evaluated based on five parameters: aroma, taste, tenderness, juiciness, and overall acceptability. Significant differences (p < 0.05) were observed in aroma, tenderness, and juiciness (Table 4). The highest aroma score was observed in T_5 (4.63), followed by T_4 (4.53), T_3 (4.50), T_2 (3.73), and T_1 (3.53). These results suggest that increasing dietary levels of L-tryptophan (0.18%, 0.20%, and 0.22%) was associated with an enhancement in meat aroma. This improvement may be attributed to L-tryptophan's role in the synthesis of volatile compounds during meat processing and cooking. As noted by Ma *et al.* (2020), amino acid metabolism contributes to the formation of aroma-active substances that enhance the sensory appeal of meat. The study of volatile compound pathways in poultry has gained importance due to their relevance in meat quality, flavor development, taste, and gut microbiota activity (Liu *et al*., 2015; Wang *et al*., 2022; Li *et al*., 2023). Furthermore, these compounds may influence animal health through interactions with the gut microbiota and contribute to environmental emissions during production (Chen *et al*., 2022).

Table 4: The effect of L-tryptophan supplementation on sensory attributes of broiler chicken meat raised under heat stress environment.

Treatment	Aroma**	Taste^ns	Tenderness**	Juiciness**	Overall Acceptability^ns
T_1	3.53[b]	4.07	3.87[a]	3.83[b]	4.10
T_2	3.73[b]	4.07	4.00[b]	4.00[b]	4.33
T_3	4.50[a]	4.20	3.90[b]	3.97[b]	4.43
T^4	4.53[a]	4.47	4.10[ab]	4.17[b]	4.57
T^5	4.63[a]	4.23	4.60[a]	4.63[a]	4.30
P-value	0.003	0.251	0.037	0.002	0.317
CV	7.19	4.21	7.07	5.85	5.91

CV: Coefficient of variation; [ab] superscript letters within column showed significant difference at $p<0.05$; [ns]not significant ($p>0.05$); **highly significantly different ($P<0.01$); T_1: Commercial Ration (Negative Control); T_2: HMR without L-tryp and SA; T_3: HMR + .18% L-tryp; T_4: HMR + .20% L-tryp; T_5: HMR + .22% L-Tryp

In contrast, taste did not show a statistically significant difference among treatments (p=0.251). Taste scores were relatively consistent, ranging from 4.07 (T_1 and T_2) to 4.47 (T_4), suggesting that while L-tryptophan may influence certain sensory traits, its effect on taste perception is less pronounced under heat stress conditions. These findings align with those of Guzik (2002), who reported that tryptophan supplementation did not reliably enhance taste-related attributes. Significant differences were observed in tenderness (p=0.037), with T_5 (4.60) scoring the highest, followed by T_4 (4.10), T_2 (4.00), T_3 (3.90), and T_1 (3.87). Similarly, juiciness scores varied significantly across treatments (p=0.002), where T_5 again showed the highest mean (4.63), followed by T_4(4.17), T_2(4.10), T3 (3.97), and T_1(3.83). These improvements suggest that L-tryptophan supplementation contributes to better meat texture and moisture retention under heat stress conditions.

The observed relationship between tenderness and juiciness is consistent with previous findings in meat science. Improved tenderness often correlates with increased juiciness, as more tender muscle fibers are typically associated with higher water-holding capacity and lower shear force (Mateescu *et al*., 2015; Judge *et al*., 2020; Briggs et al., 2021). According to Zhao *et al*. (2021) and Hassan *et al*. (2016), L-tryptophan improves these attributes by enhancing stress tolerance and antioxidant capacity, which helps preserve muscle structure and water content. Moreover, Ouyan et al. (2022) also reported similar benefits, attributing the enhanced tenderness and juiciness to reduced oxidative damage and better cellular integrity in muscle tissues.. On the other hand, chicken meat overall acceptability did not show significant variation among treatments (p=0.317), with scores closely grouped between 4.10 (T_1) and 4.33 (T_2). These results suggest that consumer acceptability of L-tryptophan-treated meat was comparable to that of the control group, despite improvements in specific sensory attributes.

CONCLUSION

This study demonstrated that dietary supplementation with L-tryptophan, particularly at levels of 0.20% to 0.22%, significantly improved key carcass traits and sensory attributes of broiler chickens reared under heat stress condition. Notable improvements were observed in dressed weight, head and drumstick yields, as well as in meat tenderness, juiciness, and aroma parameters that are essential for consumer acceptance and market value. These enhancements suggest that L-tryptophan plays a beneficial role in mitigating the negative effects of heat stress on broiler meat quality. Given these findings, the dietary inclusion of 0.20% to 0.22% L-tryptophan is recommended as a practical nutritional strategy to improve carcass yield and sensory meat quality in broilers exposed to heat stress. Future research should investigate the effects of L-tryptophan supplementation in laying hens, as well as under different intensities and durations of thermal stress. Furthermore, exploring synergistic effects between L-tryptophan and other functional amino acids or feed additives could provide deeper insights into optimizing poultry performance, resilience, and welfare in challenging environmental conditions.

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NOVELTY STATEMENT

This study provides novel evidence on the role of dietary L-tryptophan supplementation in enhancing the meat quality traits of broiler chickens reared under heat stress conditions. Unlike previous studies that focused predominantly on growth performance or physiological stress responses, this research integrates carcass parameters, meat quality indicators (cooking loss), and consumer-relevant sensory attributes. The findings highlight the potential of L-tryptophan, especially at inclusion levels of 0.20% to 0.22% to improve the water-holding capacity and organoleptic qualities of broiler meat, thereby addressing both physiological resilience and economic value under thermal stress. This study fills a critical gap in meat science by offering a targeted nutritional intervention to improve carcass yield and sensory quality in heat-stressed poultry, contributing to sustainable and high-quality poultry meat production in tropical and subtropical climates.

AUTHOR'S CONTRIBUTION

Both authors contributed equally to conceptualization, data gathering, statistical analysis, and manuscript writing and served as co-first authors of this manuscript.

Generative AI and AI-assisted technology statement

The authors declare that AI-assisted tools (ChatGPT and Grammarly) were used solely to improve English language quality and grammar. All outputs were reviewed by the authors. No AI tools were used for data analysis or interpretation.

Conflict of interest

The authors have declared no conflict of interest.

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