REMUNOM
ISSN 2178-6925

Received: 30/10/2025 - **Accepted:** 18/11/2025
Vol: 20.2
DOI: 10.61164/tjbf7817
Pages: 1-14

EFEITO DE DIFERENTES ESTRATÉGIAS NUTRICIONAIS NO CRESCIMENTO DE FRANGOS DE CORTE EM SISTEMA INTENSIVO

EFFECT OF DIFFERENT NUTRITIONAL STRATEGIES ON THE GROWTH OF BROILER CHICKENS IN AN INTENSIVE PRODUCTION SYSTEM

EFECTO DE DIFERENTES ESTRATEGIAS NUTRICIONALES SOBRE EL CRECIMIENTO DE POLLOS DE ENGORDE EN UN SISTEMA DE PRODUCCIÓN INTENSIVO

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Resumo

O presente estudo investigou os efeitos de duas estratégias nutricionais distintas sobre o desempenho zootécnico de frangos de corte da linhagem Pesadão Vermelho (Red Bro), criados em sistema intensivo. O experimento foi conduzido na ETEC Sebastiana Augusta de Moraes, utilizando 20 pintos de um dia distribuídos em dois tratamentos (n = 10): o Tratamento 1 (T1), alimentado com

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ISSN 2178-6925

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uma ração formulada pela instituição, isenta de aditivos; e o Tratamento 2 (T2), alimentado com uma ração comercial balanceada, fornecida em três fases nutricionais. O período experimental teve duração de 90 dias, durante o qual foram avaliados o ganho de peso (GP), o consumo de ração (CR) e a conversão alimentar aparente (CA). Os resultados evidenciaram diferenças substanciais entre os tratamentos: o T2 apresentou desempenho superior, com ganho médio de peso de 3.050 g, conversão alimentar de 7,21 e taxa de sobrevivência de 90%. Em contraste, o T1 apresentou desempenho insatisfatório, com ganho médio de peso de 270 g, conversão alimentar de 12,96 e sobrevivência de apenas 40%. A elevada mortalidade observada no T1, incluindo seis casos atribuídos à hipotermia, foi associada à inadequação nutricional da dieta formulada, que comprometeu o crescimento corporal, a eficiência alimentar e a capacidade termorregulatória das aves. Conclui-se que a formulação nutricional adequada, aliada ao manejo térmico apropriado, é determinante para a produtividade e o bem-estar em sistemas intensivos de criação. A adoção de dietas comercialmente balanceadas mostrou-se essencial para otimizar o desempenho zootécnico e garantir maior viabilidade econômica da produção.

Palavras-chave: Nutrição de frangos de corte, Desempenho zootécnico, Conversão alimentar, Manejo térmico, Bem-estar animal

Abstract

The present study investigated the effects of two distinct nutritional strategies on the zootechnical performance of Pesadão Vermelho (Red Bro) broilers reared under an intensive production system. The experiment was conducted at ETEC Sebastiana Augusta de Moraes, using 20 one-day-old chicks distributed into two treatments (n = 10): Treatment 1 (T1), fed a diet formulated by the institution without additives, and Treatment 2 (T2), fed a commercial balanced feed provided in three nutritional phases. The experimental period lasted 90 days, during which weight gain (WG), feed intake (FI), and apparent feed conversion (AFC) were evaluated. The results revealed substantial differences between treatments: T2 showed superior performance, with an average weight gain of 3,050 g, a feed conversion ratio of 7.21, and a survival rate of 90%. In contrast, T1 exhibited poor performance,

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with an average weight gain of 270 g, an AFC of 12.96, and a survival rate of only 40%. The high mortality observed in T1, including six deaths attributed to hypothermia, was associated with the nutritional inadequacy of the formulated diet, which compromised growth, feed efficiency, and thermoregulatory capacity. It is concluded that appropriate nutritional formulation and proper thermal management are critical to productivity and animal welfare in intensive broiler production systems. The use of commercially balanced diets proved essential to optimizing zootechnical performance and ensuring greater economic viability.

Keywords: Broiler nutrition, Zootechnical performance, Feed conversion, Thermal management, Animal welfare

Resumen

El presente estudio investigó los efectos de dos estrategias nutricionales distintas sobre el rendimiento zootécnico de pollos de engorde de la línea Pesadão Vermelho (Red Bro) criados en un sistema de producción intensiva. El experimento se llevó a cabo en la ETEC Sebastiana Augusta de Moraes, utilizando 20 pollitos de un día distribuidos en dos tratamientos (n = 10): el Tratamiento 1 (T1), alimentado con una ración formulada por la institución sin aditivos, y el Tratamiento 2 (T2), alimentado con un pienso comercial balanceado proporcionado en tres fases nutricionales. El período experimental tuvo una duración de 90 días, durante el cual se evaluaron el aumento de peso (GP), el consumo de alimento (CA) y la conversión alimenticia aparente (CAA). Los resultados mostraron diferencias sustanciales entre los tratamientos: el T2 presentó un rendimiento superior, con un aumento de peso promedio de 3.050 g, una conversión alimenticia de 7,21 y una tasa de supervivencia del 90%. En contraste, el T1 mostró un rendimiento deficiente, con un aumento de peso de 270 g, una CAA de 12,96 y una supervivencia de apenas el 40%. La alta mortalidad observada en el T1, incluidos seis casos atribuidos a hipotermia, se asoció a la inadecuación nutricional de la dieta formulada, que comprometió el crecimiento, la eficiencia alimenticia y la capacidad termorreguladora de las aves. Se concluye que la formulación nutricional adecuada y el manejo térmico apropiado son factores críticos para la productividad y el bienestar en sistemas intensivos de cría. El uso de dietas comerciales

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balanceadas demostró ser esencial para optimizar el rendimiento zootécnico y garantizar una mayor viabilidad económica.

Palabras clave: Nutrición de pollos de engorde, Rendimiento zootécnico, Conversión alimentícia, Manejo térmico, Bienestar animal

1. Introduction

Modern poultry production traces its origins to the late nineteenth century in Asia. Prior to this period, birds were predominantly raised for combat and ornamental purposes. Systematic consumption of eggs and poultry meat began only in the nineteenth century (ROCHA, 2021). The years following World War II (1939–1945) were decisive for the development of the broiler industry. The growing demand for food, driven by rapid population expansion, stimulated the intensification of poultry meat production. During the 1950s, significant advances occurred in intensive poultry farming, supported by improvements in nutrition, environmental temperature control, and genetic selection, enabling birds to reach market weight within approximately 6 to 7 weeks.

From the 1960s to the 1970s, industrial-scale production became firmly established, accompanied by the vertical integration of the production chain by large companies, initially in the United States and subsequently in Brazil. In the Brazilian context, broiler farming emerged as one of the most technologically advanced sectors, positioning the country as a global leader in both production and export of poultry meat. This progress is closely associated with the industrialization of the activity, the adoption of advanced management technologies, and the genetic improvement of commercial strains.

Brazilian poultry production began to expand substantially in the 1950s, with strong consolidation in the 1970s, driven by favorable climatic conditions, low production costs, extensive agricultural land availability, and increasing domestic and international market demand. Since the 1980s, Brazil has consistently ranked among the world's largest exporters of poultry meat.

Within the national broiler industry, the Pesadão Vermelho strain is noteworthy, particularly in more rustic or alternative farming systems. This lineage is characterized by its robustness, resilience, and adaptability to diverse

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environmental conditions, in addition to good meat quality and satisfactory performance under less intensive management.

In the state of São Paulo, broiler farming gained prominence beginning in the 1960s, especially in the capital and other strategically located municipalities. The sector experienced marked industrialization driven by the establishment of integrated production companies and slaughterhouses, accompanied by the incorporation of technological advances in management and nutrition. In the municipality of Andradina, located in the northwestern region of the state, the poultry sector received significant investments from the 1970s onward, consolidating the region as a poultry production hub due to its strategic geographical location, logistic infrastructure, and integrated production network.

The State Technical School (ETEC) Sebastiana Augusta de Moraes, founded on February 13, 1991, and incorporated into the Centro Paula Souza in 1994, has played a significant role in regional poultry development through practical activities and educational projects. Since its inception, the institution has maintained agricultural operations involving swine, cattle, and poultry initially directed toward internal consumption and later evolving into more modern production systems, such as egg production and student-led sustainable projects.

The present study aimed to evaluate the weight gain of broiler chickens of the Pesadão Vermelho strain fed two distinct types of feed. A total of 20 chicks were housed in previously sanitized facilities adapted to the basic needs of the species. The birds were allocated into two pens containing 10 animals each, differing only in the type of feed provided: one group received the standard feed formulated for the project, while the other received an alternative feed acquired by students. Losses due to infections occurred during the experimental period, reducing the total number of birds; nevertheless, zootechnical monitoring was maintained throughout the trial, with monthly weighings performed using a digital scale. The birds were reared under an intensive production system until 75 days of age, a condition that facilitated the fattening process.

2. Literature Review

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Feed quality and nutritional balance are critical determinants of broiler performance, directly influencing weight gain, feed conversion efficiency, and flock uniformity. According to Silva et al. (2023), nutritional innovations such as the incorporation of microbial protein sources and quality protein maize (QPM) have been evaluated as viable alternatives for reducing production costs without compromising nutritional adequacy. Moreover, the use of probiotics has emerged as an effective strategy to enhance intestinal health and nutrient assimilation, thereby improving feed efficiency (Kumar & Santos, 2024).

Within this framework, comparisons of nutritional composition including protein and amino acid levels, energy density, and the additives incorporated during the pre-starter, grower, and finisher phases are essential for elucidating the performance differences observed among the batches in this study. Recent research has reported variable outcomes when contrasting commercially balanced feeds with locally formulated diets. While commercial feeds typically offer superior feed conversion and greater flock uniformity, on-farm formulations can yield comparable results provided they are correctly formulated using high-quality ingredients (Oliveira et al., 2022). Critical factors for successful feeding programs include formulation accuracy, ingredient quality and preservation, and proper storage conditions. Bromatological analysis, cost–benefit assessment of each diet, and potential management failures that may have affected the performance of Batch 1 should also be considered.

Thermal management constitutes another key factor influencing broiler development. Thermal stress whether due to excessive heat or cold (hypothermia) negatively affects mortality rates, weight gain, and plumage quality. According to Souza et al. (2022), inadequate temperatures during the early rearing phase elevate mortality and reduce feed intake, ultimately impairing productive performance. Recent reviews highlight tools such as the temperature–humidity index (THI), infrared thermography, and thermal insulation of poultry facilities as effective measures to mitigate these challenges (Benício-Souza et al., 2023). In the present study, the six hypothermia-related deaths recorded in Batch 1 underscore the importance of appropriate thermal control, bedding quality

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(sawdust), and continuous monitoring of environmental temperature and humidity factors that are pivotal for survival and welfare.

Animal welfare and humane slaughter practices are fundamental components of modern poultry production. In accordance with Brazilian regulations and the guidelines of the Ministry of Agriculture and Livestock (MAPA, 2023), handling, transportation, pre-slaughter fasting, and slaughter procedures must adhere to humane standards and biosafety principles. Compliance with these measures ensures not only the welfare of the birds but also the final product quality and the scientific integrity of the experiment.

Finally, environmental enrichment and the use of functional additives have been widely investigated as complementary strategies to enhance performance and health in poultry production. According to Grigore et al. (2025), the inclusion of probiotics, prebiotics, enzymes, and alternative microbial protein sources contributes to improved intestinal microbiota balance, reduced mortality, and enhanced feed conversion. Moreover, environmental enrichment such as increased space and physical stimuli promotes improved behavior and overall welfare. Although the ETEC may face limitations related to cost and input availability, these strategies should be considered for future trials, including the incorporation of probiotics into new experimental feed formulations, with the aim of optimizing zootechnical and productive outcomes.

3. Methodology

The study was conducted at ETEC Sebastiana Augusta de Moraes, part of the Centro Paula Souza network, located at Entrada Vicinal Lourenço da Silva – km 11, Rural Zone, Andradina/SP, at an altitude of 401 meters and geographic coordinates 20°53'38" S and 51°23'01" W. The experiment was carried out under an intensive broiler production system, with the objective of evaluating the zootechnical performance of birds subjected to different dietary treatments. All procedures were conducted in Poultry House 2 under controlled conditions of management, hygiene, and biosafety.

3.1 Experimental Design

REMUNOM
ISSN 2178-6925

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A completely randomized design (CRD) was implemented, consisting of two dietary treatments with two replicates each, totaling 20 Pesadão Vermelho (Red Bro) broiler chicks, one day old at the onset of the experiment. The birds were randomly assigned to two experimental units (pens), each containing 10 animals.

Treatment 1 (T1): birds fed a diet formulated by ETEC, without additives, vitamin supplements, or growth promoters.

Treatment 2 (T2): birds fed a commercial balanced diet, provided in three nutritional phases pre-starter (1–30 days), grower (31–60 days), and finisher (61–90 days).

The birds were monitored for 90 days, exceeding the typical commercial production cycle of 42–60 days. This extended period was necessary due to inadequacies in the formulation of the experimental diet (T1), which compromised normal growth and resulted in the need for early technical slaughter.

3.2 Evaluated Variables

The following zootechnical performance variables were measured throughout the experimental period:

Feed intake (FI)

Weight gain (WG)

Apparent feed conversion (AFC)

3.3 Management and Environmental Conditions

The pens were prepared with sawdust bedding to ensure adequate thermal comfort and welfare. Environmental control was performed manually, using natural ventilation and artificial heating during the initial rearing phase. Feed and water were supplied ad libitum, and drinkers and feeders were cleaned daily to maintain sanitary conditions.

3.4 Final Considerations of the Trial

The results of the trial highlight the critical importance of adequate nutritional formulation and appropriate feed management as determining factors for productive performance, bird health, and the economic viability of intensive broiler production. The performance differences observed between treatments reinforce that a properly balanced diet is essential for achieving optimal outcomes in modern

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poultry systems.

4. Results and Discussion

During the 90-day experimental period, the principal zootechnical variables associated with the productive performance of Pesadão Vermelho (Red Bro) broiler chickens were assessed under two distinct dietary treatments: a formulated feed produced by ETEC (Batch 1) and a commercial balanced feed (Batch 2). Monitoring encompassed feed intake (FI), weight gain (WG), and apparent feed conversion (AFC). Additionally, survival rates and the final average live weight of the birds in each batch were recorded.

Table 1 summarizes the results obtained throughout the experiment.

Evaluated variables	Batch 1 – ETEC feed	Batch 2 – Commercial feed
Initial number of birds	10	10
Final number of birds	4	9
Survival (%)	40%	90%
Initial mean weight (g)	50	50
Maximum final weight (g)	400	3.350
Final mean weight (g)*	320	3.100
Mean weight gain (g)	270	3.050
Estimated total feed intake (kg)	3,5	22,0
Apparent feed conversion (AFC)**	12,96	7,21

* Estimated from the surviving birds at the end of the experiment.

** AFC = Feed intake (kg) ÷ Total weight gain (kg).

The results revealed marked differences between the two dietary treatments. Birds in Batch 2, fed a commercial balanced diet, exhibited substantially greater average weight gain (3,050 g), superior feed efficiency (AFC = 7.21), and a 90% survival rate, indicating adequate nutritional supply and appropriate management. In contrast, Batch 1, which received the ETEC-formulated feed, showed markedly reduced weight gain (270 g) and high mortality (60%), resulting in only four surviving birds at the end of the experimental period. These outcomes suggest that nutritional deficiencies and insufficient energy density in the formulated diet impaired growth and increased susceptibility to adverse environmental conditions, particularly low temperatures.

The superior performance of Batch 2 aligns with previous findings

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emphasizing the importance of adequate nutrient balance in broiler diets, especially during early developmental stages (SILVA et al., 2023; OLIVEIRA et al., 2022). Accordingly, the experiment reinforces that commercial balanced feeds promote improved feed efficiency, more uniform growth, and greater economic viability under intensive production systems.

Overall, the data demonstrate significant disparities between the evaluated batches. While Batch 2 showed enhanced zootechnical performance, Batch 1 presented poor body development, elevated mortality, and clear signs of nutritional imbalance. These observations corroborate Pesti (2023), who stresses that precision in nutrient formulation is fundamental to achieving efficient growth and optimal feed conversion in broilers.

Feed quality exerts a direct influence on metabolic processes and growth potential. Diets deficient in crude protein, metabolizable energy, and essential amino acids reduce weight gain and feed efficiency, while also impairing thermoregulatory capacity. Akinyemi et al. (2021) highlight that environmental stress whether caused by excessive heat or cold exacerbates the negative consequences of inadequate nutrition, as birds with low energy reserves and reduced body mass are less capable of maintaining stable internal temperatures.

In the present experiment, Batch 1 exhibited high mortality, including six deaths attributed to hypothermia. This pattern likely reflects the combined effects of an imbalanced diet and insufficient thermal management. According to Moreira et al. (2024), cold stress during the early rearing phases reduces feed intake and metabolic activity, resulting in weight loss and increased mortality. Given the limited muscle development and incomplete plumage observed in Batch 1, the birds' capacity for heat retention was compromised, rendering them more vulnerable to hypothermia.

Feed physical form may also have contributed to the poor performance of Batch 1. Zhao et al. (2025) report that diets with low energy density and inadequate particle size negatively affect digestibility and nutrient utilization. The ETEC-formulated feed lacking vitamin and energy supplements likely failed to meet the nutritional requirements of the Pesadão Vermelho strain, explaining the

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low final mean weight recorded in this batch.

Furthermore, the absence of functional additives such as probiotics and digestive enzymes, which have been shown to improve gut health and mitigate some deficiencies in simple diets (Hashemitabar et al., 2024), may have further compromised performance and increased susceptibility to thermal stress in Batch 1.

Collectively, the results indicate that inadequate diet formulation, combined with insufficient thermal management, impaired zootechnical performance by reducing weight gain and increasing mortality. These findings underscore the central importance of balanced nutrition, appropriate environmental control, and continuous monitoring throughout the production cycle. For future studies, it is recommended that detailed bromatological analyses of the diets be conducted, controlled heating be implemented during the initial rearing phase, and functional additives be considered to enhance digestibility and overall bird welfare.

In summary, the experiment confirms the evidence reported in the literature: feed quality and thermal management are decisive determinants of performance and economic viability in intensive broiler production. Nutritional inadequacy not only restricts growth but also diminishes the birds' physiological capacity to withstand temperature fluctuations, ultimately resulting in greater mortality and reduced productive output.

5. Conclusion

The present study evaluated the effects of two distinct nutritional strategies on the zootechnical performance of Pesadão Vermelho broilers reared under an intensive production system. The results demonstrated the critical importance of an adequately formulated and balanced diet as a determining factor for productive performance and economic viability.

A marked disparity was observed between the treatments. Birds in Batch 2, which received a commercial balanced feed, exhibited substantially higher average weight gain (3,050 g), excellent feed efficiency (FCR = 7.21), and a high survival rate (90%), indicating optimal nutrient supply and appropriate management. In

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contrast, Batch 1, fed the ETEC-formulated diet without additives or supplements, displayed severely reduced weight gain (270 g) and elevated mortality (60%), resulting in only four surviving birds at the end of the experimental period.

These findings suggest that the inadequacy of the experimental diet in Batch 1 characterized by insufficient protein, energy, and essential amino acids compromised growth and impaired feed efficiency. Furthermore, the birds' limited ability to retain heat, due to reduced muscle development and incomplete plumage, exacerbated by undernutrition, led to six deaths attributed to hypothermia, underscoring how thermal stress amplifies the detrimental effects of a nutritionally deficient diet.

In summary, the experiment confirms that feed quality and thermal management are decisive factors influencing broiler performance: nutritional inadequacy not only restricts growth but also diminishes the birds' physiological capacity to withstand temperature fluctuations, ultimately increasing mortality and reducing productive output. For future studies, detailed bromatological analyses of diets, implementation of controlled heating systems, and consideration of functional feed additives are essential to optimize zootechnical performance and animal welfare.

6. Referências

AKINYEMI, M. O. et al. Thermal stress and its impact on poultry production: mechanisms and mitigation strategies. Poultry Science, v. 100, n. 8, p. 1–14, 2021.

BRUGALETTA, G. et al. A review of heat stress in chickens. Part I: Insights into mechanisms and consequences. 2022. Disponível em: https://pmc.ncbi.nlm.nih.gov/

EMBRAPA. Portal Frangos de Corte: publicações técnicas e dados de produção. Brasília, DF: Embrapa, 2025. Disponível em: https://www.embrapa.br/

GRIGORE, D. M. et al. Toward sustainable broiler production: evaluating microbial protein sources. Agriculture, 2025. Disponível em: https://www.mdpi.com/

REMUNOM
ISSN 2178-6925

Received: 30/10/2025 - **Accepted:** 18/11/2025
Vol: 20.2
DOI: 10.61164/tjbf7817
Pages: 1-14

GUIMARÃES, A. F. F. et al. Bem-estar e enriquecimento ambiental na criação de aves de produção – uma revisão. 2025.

HASHEMITABAR, H. et al. Functional feed additives for improving growth performance and gut health in broiler chickens: a review. Animals, v. 14, n. 2, p. 123–138, 2024.

IGNJATOVIĆ-MICIĆ, D. et al. Advantages of quality protein maize use in broiler diets. 2024. Disponível em: https://www.scielo.org/

KUMAR, H. et al. Revolutionising broiler nutrition: the role of probiotics. 2025. Disponível em: https://www.sciencedirect.com/

MINISTÉRIO DA AGRICULTURA E PECUÁRIA (MAPA). Abate humanitário e bem-estar animal: normas e instruções normativas. Brasília, DF: MAPA, 2025. Disponível em: https://www.gov.br/agricultura/

MOREIRA, A. L. et al. Cold stress effects on performance, metabolism and welfare of broilers. Brazilian Journal of Animal Science, v. 53, p. e20240112, 2024.

OLUWAGBENGA, E. M. Heat stress and poultry production: a comprehensive review. 2023. Disponível em: https://www.sciencedirect.com/

PESQUISA COMPARATIVA. A comparison of growth performance, feed intake, and feed efficiency of broiler chickens fed on commercial and farm-formulated diets. 2025. Disponível em: https://www.researchgate.net/

PESTI, G. M. Applied nutrition of poultry: precision formulation and economic efficiency. Animal Feed Science and Technology, v. 306, p. 115–131, 2023.

VERCELLINO, R. A. et al. Tracking heat stress in broilers: a thermographic analysis. Animals, 2025. Disponível em: https://www.mdpi.com/

REMUNOM
ISSN 2178-6925

Received: 30/10/2025 - **Accepted:** 18/11/2025
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DOI: 10.61164/tjbf7817
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ZHAO, X. et al. Effects of feed energy density and form on broiler growth performance and nutrient utilization. Frontiers in Veterinary Science, v. 12, p. 221–234, 2025.