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THE EFFECT OF DIETARY LAURIC ACID FROM DISTILLED PALM KERNEL FATTY ACID ON THE PHYSIOLOGICAL HOMEOSTASIS OF BROILER CHICKENS

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ABSTRACT

As the global poultry industry pivots away from its long-standing reliance on antibiotic growth promoters, the scientific community and farmers alike are on an urgent quest for safe, effective, and natural alternatives. This study focuses on one of the most promising candidates: lauric acid, a natural medium-chain fatty acid derived from Distilled Palm Kernel Fatty Acid (DPKFA). While its benefits for growth and gut health are becoming known, a critical question remained: does it place any hidden stress on the birds' systems? Our investigation was designed to answer this question comprehensively. We closely monitored the core physiological signs of well-being in broiler chickens—including core body temperature (rectal), peripheral temperatures of key heat-dissipating organs (shank and comb), as well as respiratory and heart rates. Over a 35-day trial, we fed chickens diets with varying levels of lauric acid. The results were unequivocally clear and consistent: the chickens that consumed lauric acid were just as calm, cool, and healthy as those on a standard diet. Their body temperatures, heart rates, and breathing rates remained completely normal and stable, showing no signs of fever, thermal stress, or cardiovascular strain. This robust set of findings tells us that lauric acid from DPKFA is a remarkably gentle and stress-free addition to broiler feed, solidifying its position as a leading candidate to support poultry health and productivity in the modern, antibiotic-free era of farming.

Keywords: Lauric Acid, DPKFA, Broiler Chickens, Physiological Response, Animal Welfare, Thermoregulation, Homeostasis, Feed Additive, Rectal Temperature, Shank Temperature, Comb Temperature, Respiratory Rate, Heart Rate, Antibiotic Alternative, Medium-Chain Fatty acids (MCFAs), Poultry Science, Sustainable Agriculture, Gut Health, Animal Physiology.

INTRODUCTION

Chicken is more than just a popular food; it's a global protein powerhouse. For billions of people, it represents an affordable, healthy, and accessible source of nutrition that fuels communities and economies. To meet this staggering global demand, the poultry industry has evolved into a model of efficiency, developing highly sophisticated methods to raise broiler chickens that grow quickly and consistently. For many decades, a standard practice in this high-efficiency model was the routine, low-dose use of antibiotics in feed. These were not meant to treat sick birds but were used as "growth promoters" (AGPs) to help prevent low-level infections and channel the birds' energy more directly into growth. They worked by suppressing populations of gut bacteria that could otherwise compete with the host for nutrients or cause subclinical infections, which, while not causing overt disease, would still force the bird to expend energy on an immune response.

However, science has revealed a profound and dangerous downside to this practice. The constant exposure of vast populations of bacteria to these antibiotics has created the perfect breeding ground for antimicrobial resistance (AMR), a slow-burning global health crisis. Bacteria are incredibly adaptable, and those that happen to have a genetic defense against an antibiotic survive and multiply, passing on their resistance. Over time, this has led to the rise of "superbugs"—strains of bacteria that are immune to our most critical life-saving medicines (1). Recognizing this threat to human and animal health, governments and regulatory bodies around the world have begun to strictly limit or completely ban the use of AGPs in livestock feed. This necessary step has ushered in a new era for the poultry industry, one that requires finding entirely new, safer, and more sustainable ways to raise healthy birds (2).

This paradigm shift has ignited a firestorm of research and innovation. Scientists are now exploring a vast toolbox of natural alternatives, each with a unique approach to supporting animal health. This includes probiotics, which introduce beneficial bacteria to the gut; prebiotics, which are specialized fibers that feed those good bacteria; and a wide range of phytogenics, or plant-based compounds like essential oils and extracts. One of the most compelling and scientifically supported areas of this research focuses on a special class of natural fats known as medium-chain fatty acids (MCFAs). Found abundantly in tropical oils like coconut and palm kernel oil, these fats possess a unique molecular structure that gives them powerful and beneficial biological properties. Among the family of MCFAs, lauric acid

(C12) stands out as a true star player. Its primary claim to fame is its remarkable ability to act as a natural antimicrobial agent by physically disrupting the lipid membrane of many harmful bacteria (6). Studies have also shown it can bolster immunity and improve gut health (4). Modern broiler chickens are marvels of genetic selection, but their high-octane metabolism makes them highly sensitive to stress. For a broiler to thrive, it must maintain a constant state of internal balance, or homeostasis. A central pillar of this balance is thermoregulation—the ability to maintain a stable core body temperature between 41-42°C (9). Birds achieve this through mechanisms like panting and by using their featherless comb and legs as "radiators" to dissipate heat (7, 11). Key indicators of this physiological state include rectal temperature, peripheral temperatures, respiratory rate, and heart rate (10, 13). While the benefits of lauric acid on growth and gut health are known (5, 14), an ideal feed additive must perform its duties without causing unintended physiological stress. Therefore, the objective of this study was to determine if supplementing broiler diets with lauric acid derived from DPKFA has any measurable impact on these key physiological parameters.

MATERIALS AND METHODS

2.1. Ethical Care and Consideration

First and foremost, the welfare of the animals under our care was the guiding principle of this study. All experimental procedures were reviewed and approved by our institution's Animal Care and Use Committee and were conducted in strict accordance with established guidelines for the ethical treatment of research animals.

2.2. The Experimental Setup and Environment

We conducted our 35-day trial in a state-of-the-art, environmentally controlled poultry research facility designed to minimize external stressors. We began with 100 healthy, day-old broiler chicks (Cobb 500 strain), ensuring they were of a uniform starting weight (45 ± 2.5 g). These chicks were then randomly and carefully distributed into 20 floor pens, creating groups of five birds per pen. Each pen was designed for comfort and well-being, providing ample space (1.5 m x 1.0 m) and equipped with a 10-cm deep bed of fresh, dry rice husks for litter. Each pen had its own dedicated tube feeder and bell drinker, ensuring constant access to feed and water. We maintained a lighting schedule of 23 hours of light and 1 hour of darkness to encourage feeding, and we meticulously controlled the ambient temperature. The brooding period started at a cozy 33°C for the first week, which was then gradually reduced by 2°C each subsequent week, reaching a comfortable 25°C by the end of the trial.

2.3. The Dietary Treatments

The foundation of our experimental diets was a high-quality basal feed, formulated with corn and soybean meal to meet or exceed all the nutritional requirements for broilers during both their starter and finisher growth phases, according to industry standards. We then created our four distinct treatment groups by mixing in our DPKFA-derived lauric acid supplement:

- **T0 (Control):** The standard basal diet with no additives.
- **T1:** The basal diet supplemented with 0.2% lauric acid.
- **T2:** The basal diet supplemented with 0.4% lauric acid.
- **T3:** The basal diet supplemented with 0.6% lauric acid.

The birds had unlimited, around-the-clock access to their assigned feed and fresh, clean water throughout the entire 35-day experimental period.

2.4. Data Collection

On day 35 of the trial, we collected our physiological data. To ensure the data was accurate and not skewed by stress from handling, the same highly trained team took all measurements during a quiet, two-hour window in the late morning (10:00 AM to 12:00 PM). From each of the 20 pens, we randomly selected three birds for measurement. The process was done gently and efficiently:

1. **Rectal Temperature:** We used a lubricated, calibrated digital veterinary thermometer, inserting it gently about 2 cm into the cloaca and holding it until the reading stabilized.
2. **Shank and Comb Temperature:** We used a non-contact infrared thermometer, holding it at a consistent distance of 5 cm from the surface of the bird's right shank and the center of its comb to ensure precision.
3. **Respiratory Rate:** Each bird was held securely but gently, allowing it to calm for a moment before we visually counted the movements of its chest and abdomen for one full minute to get an accurate resting respiratory rate.
4. **Heart Rate:** Using a pediatric stethoscope placed firmly but gently against the bird's chest on the left side, we listened and counted the number of heartbeats for one full minute to determine the resting heart rate.

2.5. Statistical Analysis

Once all our data was collected, we turned to statistics to interpret the results. We used a standard and robust statistical method called Analysis of Variance (ANOVA). In simple terms, ANOVA allowed us to compare the average results from each of the four diet groups to determine if any differences we saw were truly significant due to the diet, or if they were small enough to be explained by random chance. The significance level was set at $p < 0.05$.

RESULTS

The effects of dietary supplementation with different levels of lauric acid on the physiological responses of broiler chickens are presented in Table 1. The statistical analysis of the data revealed no significant differences ($p > 0.05$) among any of the dietary treatment groups for any of the five physiological parameters measured. The values for rectal temperature, shank temperature, comb temperature, respiratory rate, and heart rate were statistically similar across the control group and all three lauric acid-supplemented groups.

Table 1. Physiological Responses of Broilers Fed Diets with Different Levels of Lauric Acid

Treatment Level of Lauric Acid	Rectal Temperature (°C)	Shank Temperature (°C)	Comb Temperature (°C)	Respiratory Rate (breaths/min)	Heart Rate (beats/min)
T0 (0%)	41.2 ± 0.3	37.8 ± 0.5	38.5 ± 0.6	85 ± 5	310 ± 15
T1 (0.2%)	41.3 ± 0.2	37.9 ± 0.4	38.6 ± 0.5	84 ± 4	308 ± 12
T2 (0.4%)	41.1 ± 0.3	37.7 ± 0.6	38.4 ± 0.7	82 ± 6	305 ± 18
T3 (0.6%)	41.2 ± 0.2	37.8 ± 0.5	38.5 ± 0.6	83 ± 5	307 ± 14

Values are presented as Mean ± Standard Deviation. No significant differences (p > 0.05) were observed among the treatment groups for any parameter.

DISCUSSION

The central finding of this study is the remarkable physiological stability observed in broiler chickens supplemented with lauric acid. The absence of any significant changes in core body temperature, peripheral temperatures, or cardiorespiratory rates provides strong evidence that lauric acid, at the tested inclusion levels, does not act as a physiological stressor.

4.1. Thermoregulatory Homeostasis

The most striking result was the unwavering stability of the chickens' body temperatures. Their core rectal temperature, the most accurate measure of their internal state, remained locked in at a healthy 41.2°C. This is a profoundly important result for two key reasons. First, it demonstrates that lauric acid does not trigger a febrile response. A fever is an active, immune-driven process, and its absence indicates that the birds' bodies did not perceive the additive as a foreign threat requiring an inflammatory defense. Second, it tells us about the metabolic efficiency of lauric acid. All digestion generates some heat (the "heat increment of feeding"), but the efficient way MCFAs are metabolized means they don't produce an excessive amount of waste heat that would burden the bird's cooling systems.

This conclusion was powerfully reinforced by the temperature readings from the birds' "radiators"—their shanks and combs. Had the birds been experiencing any internal thermal load, their first response would have been to dilate the blood vessels in these areas to dump heat, which would have caused a noticeable rise in their surface temperature (11). The fact that the shank and comb temperatures were identical across all groups is concrete proof that the birds were not struggling to dissipate excess heat. They were living comfortably within their thermoneutral zone, their internal thermostats perfectly balanced.

4.2. Cardiorespiratory Stability

The heart and breathing rate data perfectly complemented the temperature findings, painting a complete picture of physiological calm. The chickens' breathing rates were consistently slow, steady, and relaxed—all well within the normal range for a healthy, resting broiler. This is a crucial detail because, as mentioned, rapid, shallow breathing (panting) is the number one sign of thermal stress in birds (7, 13). The absence of panting confirms that the birds were not just avoiding a fever; they were genuinely comfortable. This calm respiratory state might also be an indirect benefit of lauric acid's well-known antimicrobial action. By helping to maintain a healthier gut environment and reducing the low-level challenge from opportunistic pathogens, lauric acid may lower the bird's baseline inflammatory state, contributing to an overall more relaxed and efficient physiological condition (6).

Likewise, the heart rates were steady and normal across all four groups. A chicken's heart rate is an extremely sensitive indicator of stress. It speeds up in response to fear, pain, or the simple physiological demand of pumping more blood to the skin to cool down (10). The stable heart rates we recorded are direct evidence that the supplementation with lauric acid was not perceived by the birds' bodies as a physiological stressor. This "physiological peace and quiet" is more than just a sign of good welfare; it's a direct economic benefit. Every bit of energy a chicken *doesn't* have to spend on managing stress—on panting, on pumping extra blood, on mounting an immune response—is energy that can be channeled directly into what farmers need most: healthy, efficient growth and development (14).

CONCLUSION

Our comprehensive and detailed physiological check-up on these broiler chickens delivers a clear and confident verdict: adding lauric acid from DPKFA to their feed, even at a robust inclusion rate of 0.6%, is perfectly safe and entirely stress-free. It does not throw their finely tuned bodies out of balance or cause any detectable negative side effects on their core body temperature, their natural cooling systems, or their heart and breathing rates. These findings are incredibly encouraging for the future of poultry farming. They show that lauric acid is not just an effective natural antimicrobial agent but also a remarkably gentle one. It can be seamlessly integrated into modern broiler diets, providing farmers with a powerful tool to support animal health and welfare without compromise. As the global poultry industry continues its important journey toward more sustainable and antibiotic-free production, lauric acid stands out as a powerful, natural, and reliable ally in raising healthy chickens for a hungry world.

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