

***Corresponding author:**

Hassan M. Al-Tameemi

Department of Microbiology, College of Veterinary Medicine, University of Basrah, Basrah 61004, Iraq
Tel: +964-7833216662
E-mail: hisan.jasim@uobasrah.edu.iq
<https://orcid.org/0000-0002-1947-798X>

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Harnessing blue light for cost-effective and eco-friendly antimicrobial solutions in poultry farming

Hassan M. Al-Tameemi^{1*}, Harith Abdulla Najem², Hiba A. Nasear³, Basil A. Abbas¹

¹Department of Microbiology, College of Veterinary Medicine, University of Basrah, Basrah 61004, Iraq

²Department of Pathology and Poultry diseases, College of Veterinary Medicine, University of Basrah, Basrah 61004, Iraq

³Department of Veterinary Public Health, College of Veterinary Medicine, University of Basrah, Basrah 61004, Iraq

Abstract

Blue light in the visible spectrum naturally fights bacteria and effectively deactivates various Gram-positive and Gram-negative bacteria and fungi using photodynamic processes. It works against drug-resistant strains within these species and is gentler on mammalian cells than ultraviolet rays or chemicals. This study evaluated blue light as an affordable way to sanitize surfaces in poultry settings, such as eggs and litter. The study used a light-emitting diode array to remove harmful *Escherichia coli* and *Staphylococcus aureus* from these items and observed how blue light affected their survival rates. Blue light (455 nm) at 30 mW/cm² for one hour decreased the survival of *S. aureus* and *E. coli* on solid agar plates to 29.88% and 21.04%, respectively, compared to non-irradiated cultures. Similarly, on untreated surfaces (such as plastic used for feeding and drinking), the survival rates dropped to 25.8% and 15.6%, respectively. The survival percentages on treated eggs were 50% (*S. aureus*) and 36.47% (*E. coli*) and 49% (*S. aureus*) and 48.2% (*E. coli*) on treated litter. Hence, blue light technology offers a promising alternative to traditional antimicrobial methods by leveraging specific wavelengths to target microbial cells. This approach can significantly reduce the microbial load in poultry environments, enhancing food safety and animal health. This paper reports the first use of blue light as an antibacterial within poultry research in Iraq, offering a fresh approach to disinfection in this field.

Keywords: blue light; antimicrobial stewardship; poultry; cost savings; anti-bacterial agents

Introduction

The poultry industry is one of the fastest growing and most important income sources for many countries. According to estimates, more than nine billion chickens were slaughtered in the United States in 2019 [1]. Global poultry meat production reached 133.3 million tons in 2020 [2]. This means there were 27.8 billion poultry birds as opposed to the 7.7 billion human population [3]. This overproduction of poultry products has adverse effects on humans and the environment. Individuals or corporations of varying capacities manage commercial poultry production [4]. Therefore, the types of farms, practices, and biological safety procedures vary from one producer to another. This causes variations in the quality